

CHAPTER 4

STRATEGY DYNAMICS – The PRINCIPLES and applying them to *Remove a Processing Backlog in a Land Registry and Keep it Low*

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CHAPTER 4

STRATEGY DYNAMICS – The PRINCIPLES and applying them to Remove a Processing Backlog in a Land Registry and Keep it Low

4.0 Introduction

Chapter 3 indicated where the *system* of Land Administration (LA) fits into the IDA (International Development Assistance) development logic, and how feedback loops affect project outputs and impacts.

The central theme of this booklet is that, by using the Strategy Dynamics (SD) approach, it is possible to test for effectiveness and sustainability, any *Performance Improvement Proposals (PIP)* in land administration (LA), during IDA project design and before large investment \$ are committed.

The *purpose of this chapter* is to: -

- Outline what Strategy Dynamics (SD) is and what it can do
- List the principles of SD
- Illustrate applying the principles with a simple example from LA, that of removing a backlog in a LR (Land Registry) and keeping it low, post IDA
- Produce a SCS (Schematic of the Core Structure) that illustrates the *system* and the dynamics of processing applications in the LR, together with the PIPs

It is not the purpose to provide a user guide¹ to Strategic Dynamics or the Sysdea software, now Sheetless.

Acknowledgement: - This chapter draws heavily on Dr Kim Warren's ideas, methodology and materials for Strategy Dynamics, Warren K (2009, 2010), and modelling software, Silico²; The backlog in the LR draws upon elements in Warren's learning model of the IT Support Company. This is gratefully acknowledged, as are his many helpful comments. However, all errors are the authors.

4.1 Strategy Dynamics and Performance

4.1.1 Strategy Dynamics in a nutshell

The SD approach, and its associated software, Sysdea, allows time based, quantified and transparent simulation models to be built showing how organisations, and the issues they face, actually function and perform over time (POT). This makes it possible to work out what to do on all key decisions across a business, and to continually update those insights as circumstances change. Past POT can be replicated, and likely future POTs generated.

A *system* view solves the challenge of improving POT because a SD simulation model enables (Warren K 2009):-

- The *Determination* if a plan will work at all
- The *design* of a system so that it can perform well
- The *management* of a system so that it does perform well
- The *fixing* of a system if problems occur

Strategy Dynamics is the application of the generic mainstream method of *system dynamics*³ to strategy questions.

The big contribution of Strategy Dynamics is that it explains how and why *systems* generate the changes to performance outcomes that occur over time, and enables bench testing of strategies and policies to make

¹ For details of the SD methodology see Warren K (2009, 2010); or online courses at <https://www.sdcourses.com/>

² <https://www.silicoai.com/>

³ System Dynamics was developed in the 1960s at MIT by Professor Jay Forrester;
https://en.wikipedia.org/wiki/System_dynamics

substantial sustained improvements to those outcomes. This is made very clear with POT (performance overtime) charts. (Sec 4.3 refers).

4.1.2 Strategy and Performance

An organisation's strategy is how it tries to reach its objectives. The objectives may be financial (e.g. profit) or non-financial (e.g. customer numbers). In LA objectives could be: -processing applications in a LR to take no longer than x weeks; a certain \$ amount of fees to be collected annually by a LR; a certain % of land/property owners to have a formal title.

Strategic management is about building and sustaining performance into the future, and this is essentially what IDA seeks to achieve.

Performance over Time (POT) is of major importance. The performance in question can be an objective, or a PI (Performance Indicator) that the organisation is trying to meet or improve.

Optional

The following videos by Dr Kim Warren provide background. <https://www.youtube.com/watch?v=cFoGdSZ3amI> 3 min; <https://www.youtube.com/watch?v=3Vx446UWGUw> 9 min

4.2 The Principles of Strategy Dynamics (SD) and Steps in the SD Approach

4.2.1 The Principles of Strategy Dynamics

In Chapter 3, Sec 3.5 the characteristics of systems were listed, together with their consequences and some examples from LA. This section lists and illustrates the principles that underpin SD. The illustrations will use as an example IDA task of *removing a long term application processing backlog in a LR, with IDA, and keeping it low, post IDA*.

The following four principles underpin SD: -

1. Explain and improve the *performance over time* (POT) of a *system*
2. Performance depends on *stocks* (the assets of an organisation), at every point in time
3. Stocks *accumulate* and deplete over time, driven by the *flow* rates into and out of the stocks
4. Flow rates are driven by *existing stocks* (causing *feedback and delays*), *external factors* and *internal organisational decisions*

These will be explained in the following sections.

4.2.2 The Steps in the SD Approach

The following are the steps in the SD approach which will be followed in this booklet. They can be considered under the headings as shown.

Design a system so that it can perform well

1. Establish the PIO (performance improvement objective(s)), with and without aid
2. Draw POT graphs (performance over time) showing past, desired future, feared future trajectories for the PIOs; also compile a Why, Why, Why⁴ (root cause) diagram and draw some preliminary conclusions re the dynamics in play.
3. Establish the *system* to be improved and sketch a SCS (schematic of the core structure) of the *system*
4. List PIPs (performance improvement proposals) with indicative inputs and durations
5. Build a SD model of the system and show that it can replicate past POT
6. Test the PIPs for effectiveness and sustainability, using the SD model, and identify an improvement strategy
7. Do financial and non-financial evaluation

Manage the system to perform well and fix problems as they arise

8. Identify KPIs and PIs (key and performance indicators) of the system

⁴ <https://online.visual-paradigm.com/knowledge/problem-solving/why-why-diagram-for-root-cause-analysis/>

9. Collect data on KPIs/PIs and compare actual to model data
10. Determine revised performance targets for one or more KPIs and calculate revised performance targets for dependent KPIs/PIs
11. Managers determine actions to be carried out
12. Repeat cycle 8-11 regularly

4.3 The Use of Illustrative Examples

This booklet explains the use of the SD approach by using a number of illustrative examples of common situations in LA in developing economies. **NB** – these are all hypothetical examples and do not relate to any real situation. This first example is a simple one that is a processing backlog in a land registry (LR). More complex examples are shown in later chapters. The story line for the backlog follows.

- **Setting** – A small regional LR in small island country of 3 processing staff; [there are quite a number of “lands officers” who deal with approvals before documentation reaches the LR]
- **The Situation 5 years ago** - aid of 5 temporary staff for 14mths was provided to successfully remove a backlog of 1,000 applications (~ 20 mth backlog)
- **The Situation now** - the backlog is back up to ~1,000; the in country Finance Department has indicated it will not consider funding an additional position until the LR can demonstrate some sustained improvement. Aid has again been requested to remove the backlog.

The PIO (Performance Improvement Objective) is to remove the backlog (with aid), and for the backlog to remain low (i.e. be sustainable) post aid. (This is step 1 in the SD approach).

4.4 Principle #1- Explain and Improve Performance Over Time (POT)

4.4.1 POT in general and for the illustrative backlog example

In IDA for LA, an improvement in POT is sought from the IDA investment. This is not fundamentally different from any enterprise (e.g. a private company, a not-for-profit, a government agency) which seeks, by selected investment, to achieve certain objectives, and improve their POT.

Fig 4.1 illustrates a POT graph of past performance in an LR for the Performance Indicator (PI), backlog, (applications waiting to be processed at the end of each month). This POT is for the illustrative backlog example outlined in Sec 4.3.

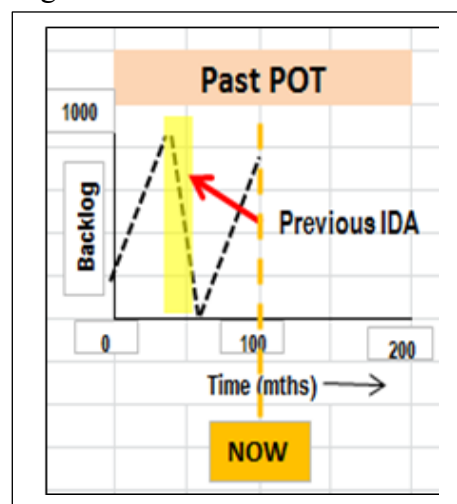
POT graphs are quantitative.

The vertical axis is the objective, or performance indicator (PI), whose performance is being examined, in this case backlog.

The horizontal axis is time based, with the time interval and the simulation time span being suitable for the application. For LA a suitable time interval could be a month, a quarter or a year, with a time span of 5 to 25 years depending on the particular LA operational entity under consideration.

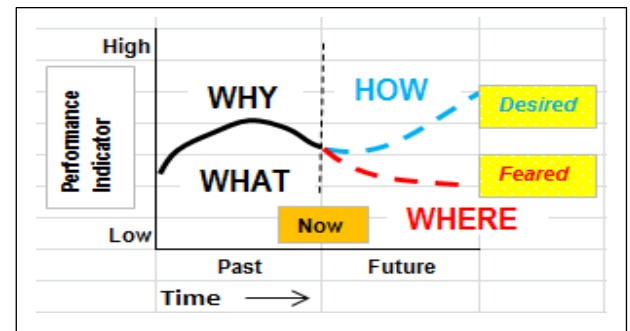
Even if exact figures are not known, best estimates should be used. In compiling this backlog graph numbers were only available over certain time periods, so they should be regarded as approximate

Fig 4.1



The yellow shaded area of Fig 4.1 is where the previous IDA was used (months ~40-54) to remove the backlog. However, the backlog has again increased up to the NOW point in time (~month 100).

Fig 4.2



Before considering HOW future performance can be improved (the desired future trajectory), it is necessary to know, Warren (2009): -

- WHAT the past performance has been
 - WHY that past performance has followed the time path that it has.
 - WHERE future performance is feared to be going
- Fig 4.2 illustrates this.

WHAT the past performance has been for the backlog example is shown in Fig 4.1 from months 0 to 100.

In seeking to explain WHY the past performance has followed the time path that it has in Fig 4.1, the following has been found useful:-

- Compile a WHY, WHY, WHY (root cause) diagram as shown at Annex A and draw observations re the dynamics in play. (This can be done as part of a brainstorming session during design with local team members)
- Update observations after the compilation of the SCS (see Sec 4.9)
- Update after using the SD model (Chapter 5 Sec 5.2 refers)

What the WHY, WHY, WHY diagram (Annex A) indicates: -

- That demand (applications for processing) is greater than supply (capacity of the LR to process)
- Processing capacity is low because: - productivity is low (low skills; process & workflows unclear and cumbersome); budgets are insufficient for adequate maintenance and technology)

4.4.2 POTs for the IDA task of removing a processing backlog in an LR and keeping it low, post IDA

This section shows the POT graphs for backlog which is step 2 of the SD approach.

- Fig 4.1 showed the POT for past performance.
- Fig 4.3a indicates the desired future POT (the blue line) where the backlog is removed and remains low, post IDA.
- Fig 4.3b indicates feared future 1 POT (the red line) if no IDA is provided, i.e. the backlog continues to increase.
- Fig 4.3c indicates an alternative feared future 2 POT (the red line) if the same type of IDA, temporary processing staff, is again provided. i.e. the backlog will be removed but will increase again once IDA ceases. When the backlog again reaches some critical level, IDA will again be requested to fund temporary staff to again remove the backlog. (An oscillation occurs; this is called *the fix that fails* in system dynamics).

Fig 4.3a

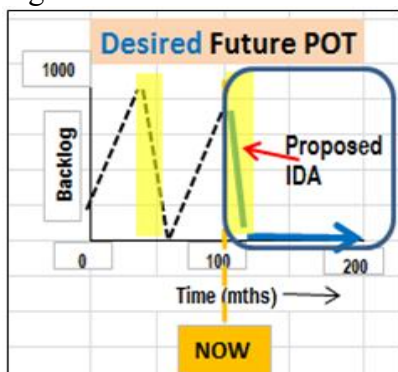


Fig 4.3b

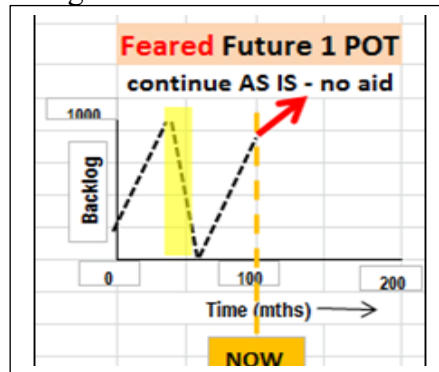
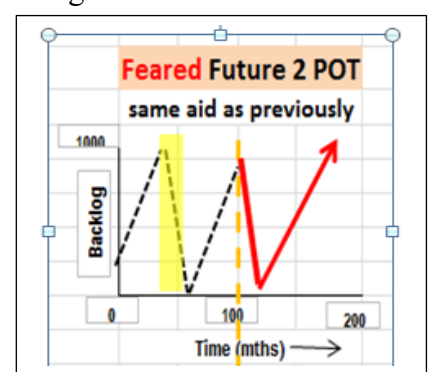


Fig 4.3c



In practice the POT lines would not be straight as illustrated but rather more curved.

The need is to determine an improvement strategy that will result in the desired future POT illustrated in Fig 4.3a.

Here POT graphs are only introduced. Fully explaining past POT and determining HOW to improve future POT relies on the next three SD principles.

Before that, the importance of an LR and having a low backlog is indicated.

4.4.3 The importance of a Land Registry (LR), and of keeping the processing backlog low

The importance of an LR

A Land Registry (LR) is a core LA operational entity. Its strategic position was shown in Fig 2.1.

The LR is fundamentally important in its own right because: –

- It is (in developed economies) the authoritative source of all⁵ rights and interests in land/property at any point in time
- It provides legal documentation and information pertaining to those rights and interests
- It records all changes in rights and interests
- It acts as a collector for government fees and taxes on property dealings (generally a significant revenue stream to government)
- The authoritativeness on the rights and interests in property held by the LR are held in high confidence by the community, accepted legally, and thus contributes to minimising disputes over property (thus fostering social stability), and allows lenders (e.g. banks) to provide development capital by accepting the title to property as collateral, and not charging exorbitant interest rates.

The LR is very important as a base building block for other upstream LA operational entities as: –

- LR records, when integrated with land parcel boundary ownership data, forms the base layers of a Land Information System (LIS), which can be used by all the other LA operational entities
- All other operational entities can "overlay" their geo referenced data to the property base layers of the LIS
- Can save upstream operational entities considerable establishment and maintenance costs by sourcing property LIS from the LR

The importance of LR and its data can be gauged by looking at what happens when the LR is not highly effective nor its records authoritative: –

- Land/property disputes can be very difficult to resolve and are likely to increase
- No or little long-term lending, using a title as collateral occurs, thus reducing the major source of development capital to property owners
- The agencies responsible for upstream LA operational entities incur greater establishments and operating costs in establishing their own silos of property information which can quickly become outdated

The importance of a LR was made by English et al (2019) when reporting on lessons and guiding principles from DFID (UK) land sector support programs. They noted, “without an accurate, well-run and transparent land registry, local and national governments cannot approve and register legally secure land-rights transfers through sale, inheritance or gift”.

The importance of keeping the LR processing backlog low

A large long term LR processing backlog in developing economies, and concurrent long customer waiting times for LR staff to process applications can lead to a number of adverse effects e.g.: –

- Titleholders avoid using the LR for their property dealings
- The payment of informal fees to “speed up” LR processing
- A lessening of public trust in the LR

The basis of a downward spiral (a reinforcing feedback loop) is thus established. Hence, it is very important for IDA, not just to remove the backlog, but also to endeavour to ensure the backlog remains low, post IDA.

⁵ in some jurisdictions the LR may only cover privately owned land/ property; where there is a separate Registry of government land, and where some of that land is leased, the same importance applies to the government land registry.

While removing the backlog with IDA assistance can easily be done, using temporary processing staff, keeping the backlog low post IDA i.e. (achieving sustainability), can be a little more difficult (Fig 4.3b, c refers). Annex D of Chapter 2 illustrated typical (large) gaps between *feared* and *future* POTs for a number of LR performance indicators. Annex E of Chapter 2 showed that removing a backlog in an LR is only one of a number of tasks that may be necessary to improve the operations and quality of an LR and to increase its efficiency and effectiveness.

Achieving sustainability post IDA by keeping the backlog low, would be a good indicator that further IDA to further improve LR operations could be effective.

The next three sections explain the remaining SD principles and then apply them to the backlog example.

4.5 Principle #2 - Performance depends on Stocks at every point in time

In Sections 4.5, 4.6 and 4.7 the SD principles are illustrated by building up a small SD model. This model has the setting of processing applications in a LR, but the structure and numbers have been kept simple, hence it is not the same as depicted by the POT in Fig 4.1. The illustrative backlog example of Sec 4.3 and its POT in Fig 4.1 will be picked up again in Sec 4.9 where the four SD principles will all be applied to it.

4.5.1 Stocks and their depiction

Stocks (a technical term in system dynamics) are the resources or assets of an organisation. These assets may be tangible (can be seen, bought, sold, counted) such as staff, equipment, products, capacity, etc. and intangible (soft factors) such as morale, pressure, reputation, knowledge etc. Assets can have “attributes”, qualities of the resource, such as staff skills, staff experience, customer value, product functionality etc. A stock is depicted⁶ as a box (Fig 4.4a), and this can be considered as a reservoir which holds the asset

In LA tangible assets can be such as titles, titleholders who use the LR, permanent LR staff, temporary IDA funded personnel employed to assist with a once off improvement task, viz remove a processing backlog, conduct initial recording of property rights (IRPR), improve the operations of a LR.

Intangible assets can be morale of LR staff, level of public trust/reputation in the LR, propensity to charge informal fees. Attributes can be such as staff capabilities, quality, coverage of LR records.

In this backlog example only tangible assets (Titleholders, staff, applications) are used. In the second illustrative example (Chapter 9), intangible attributes of quality and reputation are included. In Chapter 10, the third illustrative example, intangible attributes of skills and morale are included.

Fig 4.4a shows a *stock* of “Titleholders who use the LR”, (TH who use LR). The blue line shows the value of the stock at any time, from time 0 to 60 months. At time 0 there are 10,000 titleholders who use the LR, and at time 60, 11,200.

Fig 4.4b is similar for the number of staff in the LR (LR Staff). It shows an increase of one staff for a short period of time.

Fig 4.4a

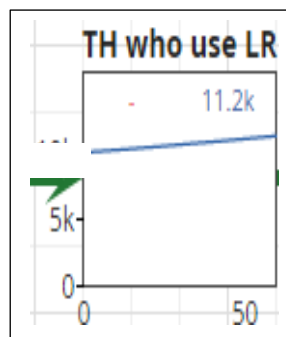
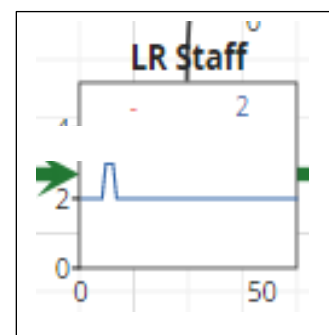


Fig 4.4b



⁶ The modelling software Silico was used to illustrate the Figs in this section

4.5.2 How Performance depends on the value of the *stock* at every point in time

Fig 4.5a

Fig 4.5a show how the value of *applications generated*, depends on the value of the stock, *TH who use LR*.

Applications generated is termed a variable (may be a constant number as shown here, or changing with time). It is the typical monthly % of Titleholders who use the LR and who lodge applications into the LR.

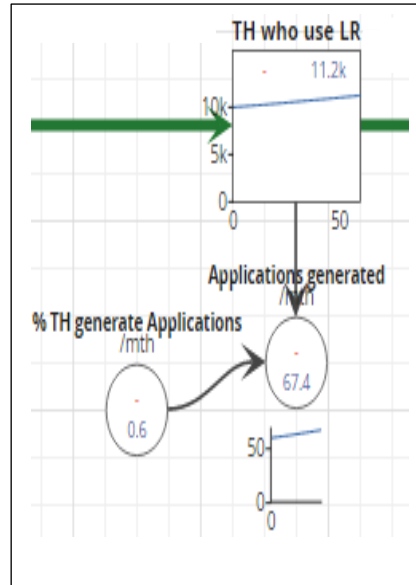
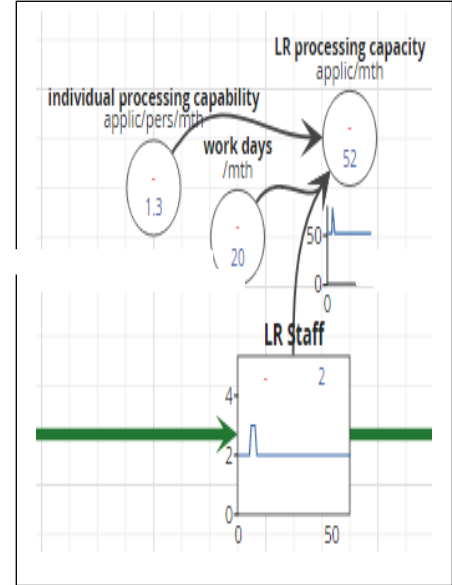


Fig 4.5b



In Fig 4.5a it can be seen that the value of *applications generated* varies at every point in time from about 60 to 70. The formula is $\text{Applications generated} = \text{TH who use LR} \times \% \text{ TH generate Applications}$

Similarly in Fig 4.5b a value is calculated for *LR processing capacity* [= individual processing capability x effective workdays x LR staff]. It can be seen that the LR processing capacity increases with the short term increase in the stock, *LR staff*.

Summary - If the value of the Stock changes (e.g. *Titleholders who use the LR*, *LR Staff*, (or any of the associated variables)) then the calculated values of *applications generated*, or *LR processing capacity* will respectively also change. [Principle #2].

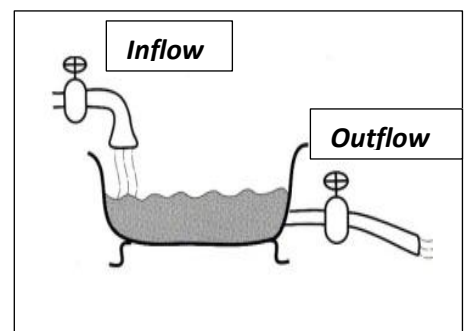
4.6 Principle #3 - Stocks accumulate and deplete overtime, driven by flow rates

4.6.1 The bathtub analogy

The bathtub analogy, Fig 4.6, is often used in system dynamics to illustrate how the amount of water in the tub (the *stock*) at any point in time will depend on the amount *flowing in* and the amount *draining out*, as well as what was in the bathtub initially. i.e. Stocks can only change by flows. The *stock* (bathtub) units are litres.

Inflow and *outflow* (the *flow rates*) are expressed in the same units as the resource but per periods of time (e.g. litres/minute).

Fig 4.6



4.6.2 How stocks accumulate and deplete

Fig 4.7a is termed a stocks and flow diagram. It shows the SD symbols corresponding to the bathtub analogy of Fig 4.6. The *stock* is Cash in Bank (in \$), the *inflow* on the left hand side is *Cash in* (in \$/mth), the *outflow* on the right hand side is *Cash out* (\$/mth). The simulation period is from months 1 to 12.

Fig 4.7b shows Cash at the bank at the beginning of each month when starting Month 1 with \$2000 in the bank, and with Cash in of \$1000/mth and Cash out of \$800/mth. The Cash at the bank at the beginning of each month is shown by the blue line in the stock.

Fig 4.7c shows, in spread sheet form, the relevant calculations.

- At start of month 1 there is \$2000 in the bank
- At start of month there is in the bank \$2,200 [= \$2000 (start mth 1) + \$1000 (cash in) - \$800 (cash out)]
- And so on for other months

Fig 4.7a

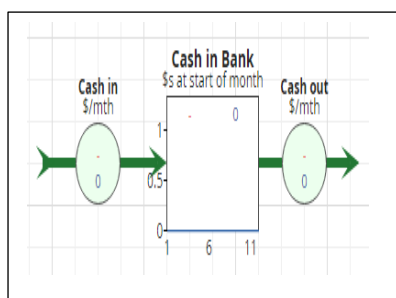


Fig 4.7b

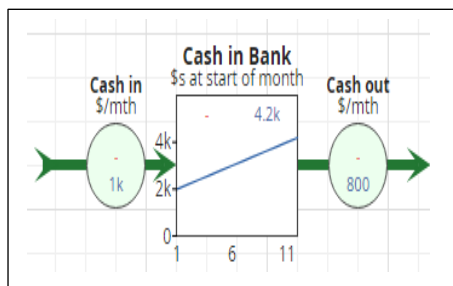


Fig 4.7c

Month	Cash in bank (at start of month)	Cash IN	Cash OUT	Cash in bank (at end of month)
1	\$2,000	\$1,000	\$800	\$2,200
2	\$2,200	\$1,000	\$800	\$2,400
3	\$2,400	\$1,000	\$800	\$2,600
4	\$2,600			

NB – The calculations SD does are no different to those done in a spreadsheet. Every link is a set of cell references; every object holds a formula just like a spreadsheet except the formula is in natural language not A\$12 * \$B\$3. The great value of SD is: -

- The graphical building blocks/symbols and layout (linkages) to build and show the transparent logic,
- The ability to embed the relevant formula,
- The integral POT graphs show what is happening over time.

4.6.3 How Titleholders accumulate and deplete

Figs 4.8a and b shows Fig 4.5a expanded to include an *inflow* and *outflow*.

The *inflow*, *New TH who use LR*, can come from two sources; from new Titleholders created through subdivision and new titleholders from initial property rights recording.

The *outflow*, *TH ceased*, can come from two sources; Titleholders ceased due to subdivision and titleholders who cease using the LR⁷ due to the long waiting times for processing at the LR⁸.

Fig 4.8a show only an inflow of 19- 25 new TH/mth, with an *outflow* of 2 titles ceased/mth. This give rise to an accumulation in the *stock*, TH who use LR₂ from 10,000 titles at the beginning to 11,200 at month 60.

Fig 4.8b builds on Fig 4.8a by including an *inflow* of Titleholders from Initial Rights Recording (assuming such a program was underway). This shows an initial inflow of ~200 new titleholders/mth, starting about month 24, and rising to ~400 /mth by month 60. It can be seen that the number of Titleholders who use the LR has increased about two fold, and the number of *applications generated* has also increased significantly. The LR would need to be prepared to handle this significant influx of new titleholders and the subsequent work generated. This is examined briefly in Chapter 9 and more fully in a later chapter.

⁷ Conducting land/property transaction outside of the LR is a real option in developing economies where sellers and buyers may see little advantage in going through a LR. Winning back to the LR those who do not use the LR is examined in Chap 9.

⁸ This effect is examined when incorporating feedback loops into the model in Sec 4.7.1

Fig 4.8a

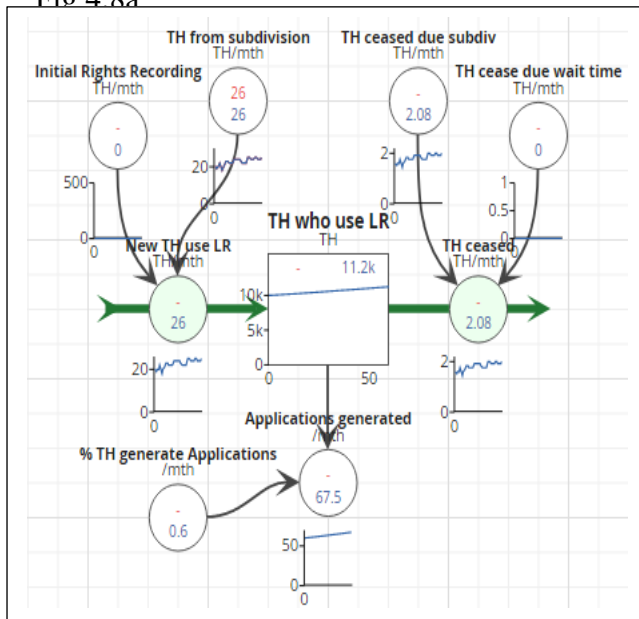


Fig .8b

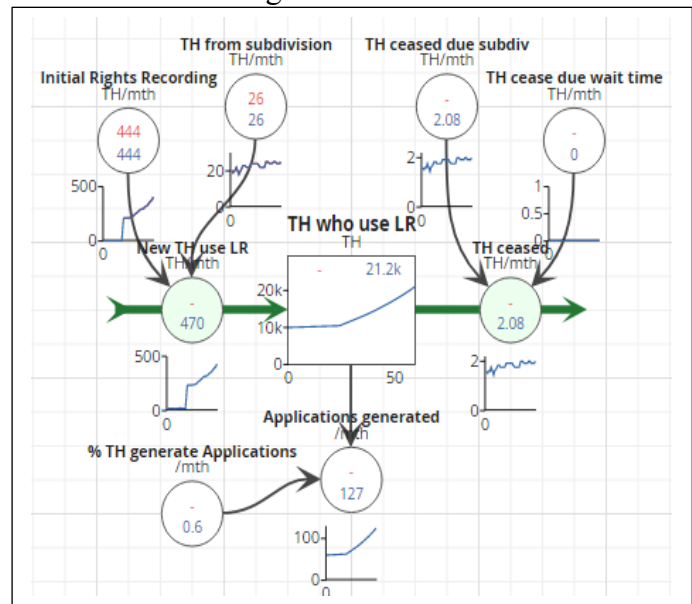


Fig 4.8 portrays **DEMAND**, the lodgment of applications from LR customers to be processed by the LR.

4.6.4 How Staff accumulate and deplete

Fig 4.9 can be considered in two parts. The first part is the *stock*, LR Staff, with its *inflow* and *outflow*, while the second part is the variable, LR Processing capacity, whose value is dependent on the value of the stock, LR Staff, at any time.

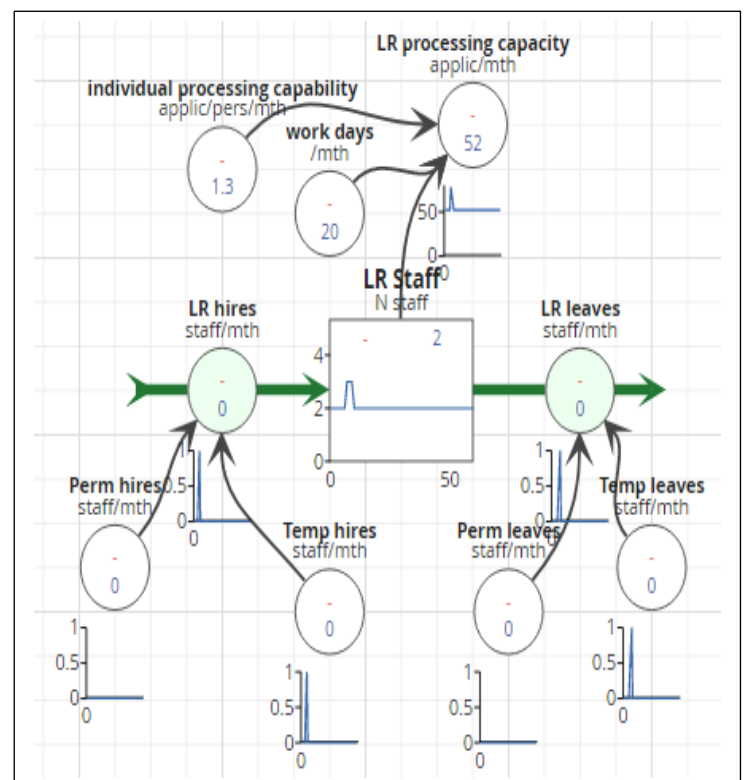
In the first part the *inflow* is *LR hires* [= Permanent hires + temporary hires], while the *outflow* is *LR Leaves* (= Permanent leaves + Temp leaves).

The initial value of the stock (the number of staff in the LR) at the start (time 0) is 2, as shown initially by the blue line in the stock.

A single temporary hire occurs at month 7 and that person leaves at month 9 (shown by the blue “spikes” of value 1 in the associated variables).

The blue line in the *stock*, is the number of LR Staff at any point in time. It reflects the accumulation and depletion of the stock caused by its *inflow* (LR hires) and *outflow* (LR leaves). It can be seen that the number of staff is initially 2, then rises to 3 with the temporary staff hire, drops back to 2 with the departure of 1 temporary staff.

Fig 4.9



Perm = permanent; Temp = temporary

The second part is the calculation of LR processing capacity⁹ [=LR staff x workdays x individual processing capability¹⁰ x LR staff]. In Fig 4.9 the small graph beside the variable, LR processing capacity, shows the number of applications processed/mth by the LR as a whole, over the 60 months. This is a POT graph. The number of

⁹ Capacity is the number of applications that the LR staff as a whole can process; it is expressed in application/month.

¹⁰ Capability (or productivity) is the individual ability to process an application expressed in applications/person/day; it depends in part on the skills level of the individual, work flows, procedures, and supporting technology

applications processed/mth varies from ~50 to ~80 at different points in time, largely dependent of the value of the stock, the number of staff in the LR at the same point in time. (Fig 4.5a, b and the associated text refer).

Fig 4.9 portrays **SUPPLY**, the provision of processing capacity by the LR staff. Annex B lists for LA some names and units for resources (stocks), and names and units for associated inflows and outflows.

Summary - The level of a resource (and hence a performance objective) at any point in time, is totally and exclusively explained by the stock's (assets) history of inflows (gains) and outflows (losses). **[Principle #3]**

4.6.5 Linking Demand and Supply

Fig 4.8a depicts DEMAND, applications submitted to the LR for processing, while Fig 4.9 depicts SUPPLY, the capacity of the LR to process submitted applications. The ideal situation is where SUPPLY is just greater than DEMAND so that backlogs and waiting times are very short, and customers are happy. In this illustrative case, the situation is that there is a large backlog and long waiting times, a not uncommon situation in developing economies (see Section for Registering a Property in World Bank Doing Business scores <http://www.doingbusiness.org/en/data/doing-business-score?topic=registering-property>)

A step in building the dynamics of the system is to link demand and supply in the SD model. Fig 4.10 shows the linkage of Figs 4.8a and Fig 4.9 with some additions. The addition is a section call Supply servicing Demand highlighted in red in the middle of Fig 4.10.

Fig 4.10

The added section of *Supply servicing Demand*

Another stock has been included, that of Applications to be processed (or work to be done or backlog). This provides the cumulative (total) number of applications that require processing at any point in time. Its inflow is "applications lodged" and its outflow is "applications processed" which is equal to the "LR processing capacity (link indicated in red).

Linking SUPPLY and DEMAND sections to Supply servicing demand

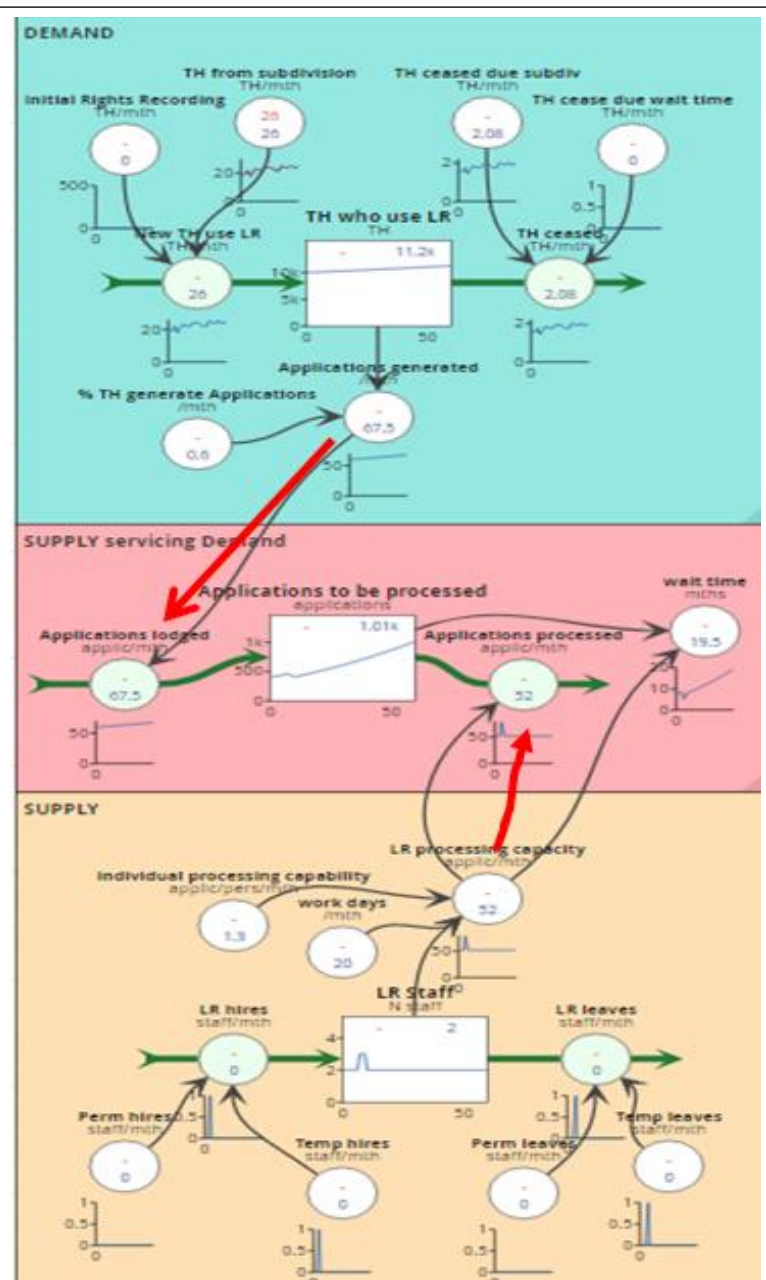
The **red arrows** indicate the linkages. In demand from applications generated to applications lodged (are equal). In supply from LR processing capacity to the outflow of applications processed.

A variable "waiting time" has been added (= applications to be processed /LR processing capacity). This gives an indication of expected waiting time (in mths) for an application to be processed.

WHAT this model is indicating

That over the 60 months, with mostly 2 staff in the LR, the applications to be processed is likely to increase from 500 to ~1,000, and the waiting time to increase from 7 to 20 months.

The **WHY** for the **POT** of this large backlog is that DEMAND > SUPPLY. i.e. the rate of applications lodged (~65/mth) is greater than the LR's processing capacity (~50/mth). Thus the backlog continues to increase.



Performance Improvement Proposals (PIPs) for removing the backlog are discussed in Sec 4.9.1 and *tested for effectiveness and sustainability* in Chapter 5.

Some characteristics of the SD model in Fig 4.10

The SD model illustrated in Fig 4.12 has features of numeracy and transparency.

- **Numeracy** – all values and results are numeric, rather than descriptive
- **Transparency** – there are no hidden implicit assumptions. The logic (structure), initial values and formulae used are readily apparent, can be easily changed and instantly recomputed. POT (performance over time) graphs are shown.

These characteristics, and the value they bring, are further commented on in Chapter 8.

Optional

Video 22 of the Silico Guide <https://www.sdcourses.com/silico-guide> outlines stocks. Video 26 demonstrates inflows and outflows to fill and drain a stock. Video 11 shows the linking of objects to enable calculations. Video 12 shows how to add a formula to calculate values. A longer video 1 show a simple credit card model.

4.7 Principle #4 - Flow rates are driven by existing stocks, causing feedback, and affected by delays, external factors, and internal organisational decisions)

4.7.1 Feedback and delays

Feedback loops are a distinguishing feature of system dynamics and are used to incorporate indirect cause and effect. Feedback loops were introduced and illustrated in Chap 3 Sec 3.4. Long waiting times for applications to be processed gives rise to indirect cause and effect, or “effects on”, which, via the core structure of the model (the plumbing of the model), generate *feedback*.

Waiting time causes three different “effects on”: -

1. Effect on Titleholders who cease using the LR; feedback loop #1 (FBL#1) (depicted by the red dashed line in Fig 4.11)
2. Effect on LR staff leaving (FBL#2) (depicted by the green dashed line in Fig 4.12)
3. Effect on LR staff hirings (FBL#3) (depicted by the blue dashed line in Fig 4.12)

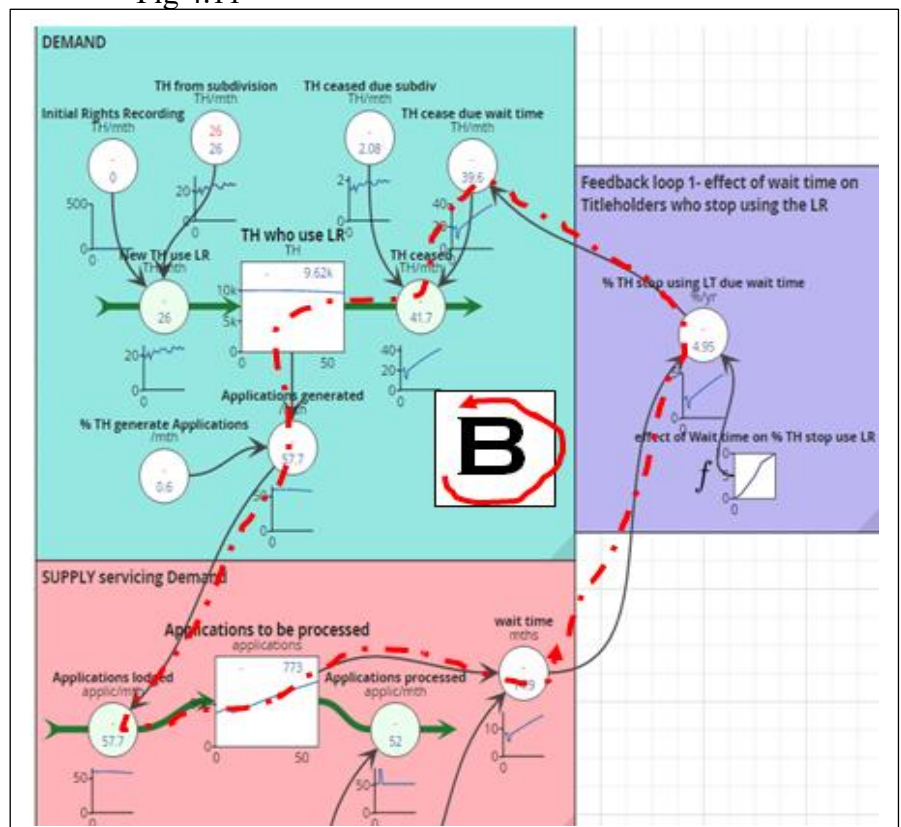
Fig 4.11 shows the first feedback loop incorporated into the SD model, and these loops are described in the following paras.

The **first feedback loop** (FBL#1) affects the DEMAND side and is depicted in red in Fig 4.11. It flows from the *wait time* to the outflow of Titleholders who use the LR.

As the waiting time increases there is an increase in customer annoyance at the increased waiting time, leading after a *delay* of perhaps 3 -6 months, to some titleholders deciding not to conduct further land transactions using the LR (i.e. an *outflow*) thus causing a decrease in the stock, Titleholders who use the LR

This decrease in the stock causes a decrease in applications lodged, causing a decrease in applications to be processed, and a subsequent decrease in waiting time.

Fig 4.11



FBL#1 is termed a **balancing (B)** feedback loop as an increase in waiting time at the start, results in a decrease in waiting time, after it has travelled through the loop described above.

The numerical effect of this balancing loop can be seen in Table 4.1 which compares Fig 4.10 (no feedback loop) with Fig 4.11 (has the first feedback loop included).

Fig 4.12 includes feedback loops 2 and 3.

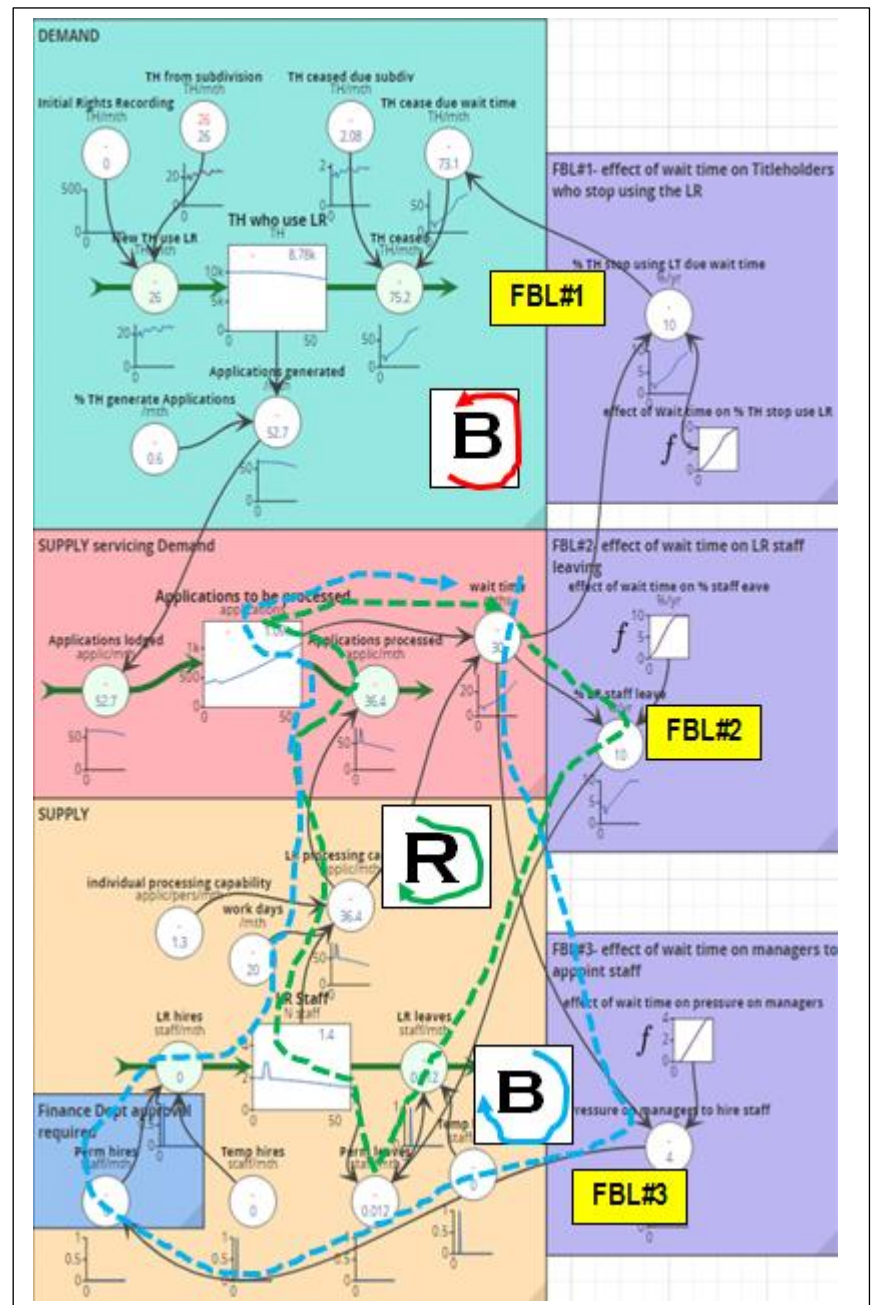
Fig 4.12

The **second feedback loop** (FBL#2) affects the SUPPLY side and is depicted in **green** in Fig 4.12. It flows from *waiting time* to the outflow, LR staff *leaving*.

An increase in waiting time leads to pressure on staff to process more applications, which leads some staff to leave, after a *delay* of perhaps 1-6 months. When staff leave this decreases the number of staff (the *stock* LR Staff), which decreases the LR processing capacity, which increase waiting time.

This is termed a **reinforcing (R)** loop as an increase in waiting time at the start results in an increase in waiting after it has travelled through the loop described. This is a negative (-) R loop as it is producing an undesired increase.

NB- in LR in developing economies the effect of this loop is likely to be mild as long waiting times tend to be treated as the norm, and LR staff tend not to leave secure government jobs.



The **third feedback loop** (FBL#3) also affects the SUPPLY side and is depicted in blue in Fig 4.12. It flows from waiting time to the pressure on management to hire additional LR staff.

As waiting time increases, LR customers put pressure on LR management and elected officials to hire additional LR staff. Additional staff increase LR processing capacity which causes a decrease in waiting time. This is a **balancing (B)** loop.

Note: for FBL#3 to be active a management decision must be made to actually hire more LR staff. (More on *decisions* is in Sec 4.9). There can be a long delay (6-24 mths) in developing economies from the actual LR

management decision to prepare a case requesting more staff, until new staff actually arrive. The time delay can be for a Finance Department to approve the post and for the required salary to be included in an approved Agency annual budget. A person then has to be recruited and actually arrive in post. There can be a further delay while new staff gain the necessary skills and productivity.

In Fig 4.12 a blue box is shown around the variable Permanent hires indicating that Finance Department approval has to be obtained before hiring new staff. In this example Finance has withheld approval so no staff have been appointed, and FBL#3 has no effect.

Table 4.1

Table 4.1 shows the effect of incorporating the feedback loops on some of the stocks, flows and variables. Fig 4.10 shows the structure with no feedback while Fig 4.12 includes feedback.

	Values at month 60		
	no feedback	with FBL#1	with FBL#1&2
TH who use the LR	11,200	9,600	8,780
waiting time (mths)	19.5	14.9	30
TH who cease using due to long wait time	0	40	73
Applications lodged	67	58	53
applications to be processed	1,010	773	1,090
N LR staff	2	2	1.4

The mechanics¹¹ of the effect of” xxx on yyy

Fig 4.13a

Fig 4.13 show FBL#1 (feedback loop #1) enlarged from the image of the model in Fig 4.12. The effect was on titleholders who cease using the LR (*TH cease due wait time*) due to the waiting time for processing applications (*wait time*). This effect is via a graphical function/look up table. Figs 4.13b & c show enlargements as a graphical function and a look up table respectively.

Fig 4.13b

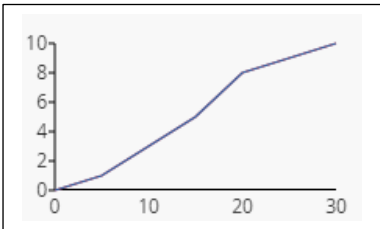
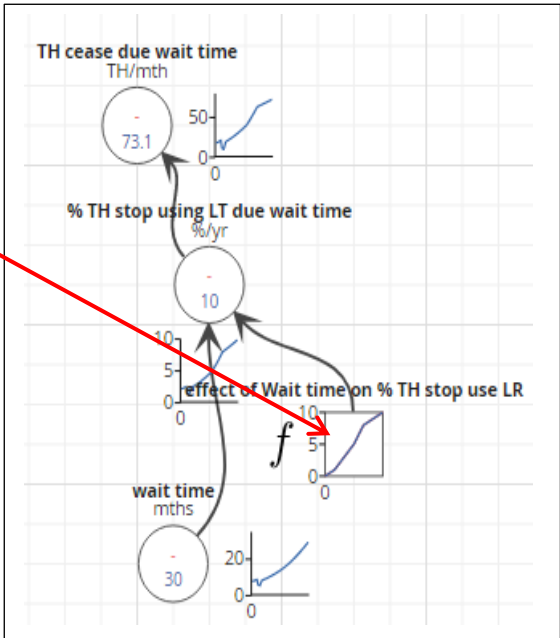


Fig 4.13c

0	0
5	1
10	3
15	5
20	8
25	9
30	10



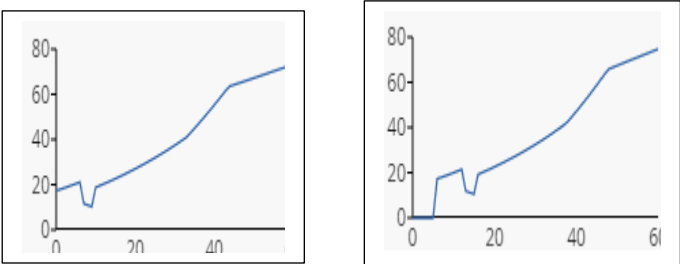
In Fig 4.13b the X axis is the waiting time in months, and the Y axis is the % per year of titleholders who will stop using the LR. In each month of the simulation the waiting time is calculated, the % per year is determined, and the number of titleholders who stop using the LR is calculated.

The mechanics of FBL #2 & #3 are similar. The shape and values in the graphical function will depend on the particular circumstances, though, investigation and experience is required in deciding on the curve.

Delays are common in feedback loops and can have a significant effect. Fig 14a & b show POT graphs for TH cease due wait time with no delay, and with a 6 mth delay respectively. The effect of the delay in Fig 4.14b is easily seen.

The effect of the delay will flow through the model via the feedback loops.

Fig 4.14a no delay Fig 4.14b 6 mth delay



¹¹ The mechanics shown use the Silico software

Effects of Feedback Loops on the POT of a system

The POT of a system is largely determined by the core structure of the system and the causal relationships (nonlinear, *feedback loops with delays*) illustrated above in Figs 4.11 to 4.14).

The interaction of the various feedback loops over time produces the dynamic (changes over time) characteristic to the system. Non-linearity (represented as graphical functions) determines the strength of feedback loops over a stock at any point in time. A visual inspection of Fig 4.12 show that the different duration of the delays will cause different rates of inflow and outflows to the various stocks at particular times, causing the feedback loops to have different effects. Delays often cause things to get worse before they get better.

In LRs *in developing economies* the feedback loops are often coupled with long delays. Long waiting times can be considered usual, and a lack of budget from a treasury department is often given as a reason for an inability to improve the situation.

In LRs *in developed economies* the feedback loops are often coupled with short delays, as LR customers (individuals and corporates) would demand action from senior public servants and government ministers if LR processing was taking too long.

Feedback loops and nonlinearity allow feedback loop dominance to change. A reinforcing loop in a model can dominate the stock giving exponential growth. As time goes on the balancing loop can start to dominate so the stock begins to decelerate in the shape of a straight line and then to exponential decay.

4.7.2 Decisions

Decisions (taken or not taken) can have an impact on the dynamics of a system. An example of the incorporation in a model of a “Decision Required” was shown in Sec 4.7.1 and Fig 4.12 when discussing feedback loop #3 (FBL#3). This feedback loop involved pressure on LR management by customers to reduce the long waiting times by appointing more LR staff to process applications thus reducing the waiting time. However, LR management cannot appoint any extra staff unless the Finance Department have approved (made a decision) funds for the position. In Fig 4.12 funding approval was not given, hence feedback loop 3 is not active.

Decisions can be external or internal.

External Decisions

External decisions can be considered as out of management control, but still need to be taken into account by management. Some types of external decisions could be those relating to, the introduction of new laws, a Government decision to transfer a LR from a department of justice to a department of lands or to form a PPP (Public Private Partnership).

Internal Organisational Decisions by Management of a Lands Agency or LR

The types of Decisions that might be considered will depend on the aspect of LA being examined. Some areas could be: -

- Remove a processing backlog (the example in this chapter)
- Improve the quality and reputation of the LR (covered in Chapter 9).
- Increase the number of Titleholders who use the LR by a campaign to convince those titleholders conducting land transactions outside the LR, of the benefits to sellers, buyers, lenders of the advantages of using the LR (covered in Chapter 9).
- Increase the LR annual O&M (operations and maintenance) budget (covered in Chapter 9).
- Increase the average skill level of staff (covered in Chapter 10.)
- Conduct IRPR (Initial Recording of Property Rights) to increase tenure security to landholders. IRPR would significantly increase the number of Titleholders and the number of applications submitted to the LR (covered in a later chapter).
- Reduce the prevalence of the payment of informal fees (covered in a later chapter).

- Making LR fees more affordable to the average landholder.

In Sec 4.3 the story line for this example was introduced. The PIO (performance improvement objective) was *to remove the processing backlog in the LR (with aid) and to keep it low (post aid)*. The possible “internal management decisions” re achieving this PIO would relate to what actions or PIPs (performance improvement proposals) would most likely reduce the backlog and keep it low. Possible PIPs are examined in Sec 4.10.

Summary – Secs 4.4 to 4.7 inclusive which cover the four SD Principles

Sections 4.4 to 4.7 explained the four principles that the SD approach is based on, and illustrated their application by progressively building a simple SD model for the *system* of applications being generated and processed in a LR. Fig 4.12 showed an image of the SD model.

As stated in Chapter 1, the aim of this booklet is to show how the SD approach can be used and the results obtained via illustrative examples, and not to show how SD models are built. For those interested in learning to build models, the online core and extension courses¹² of Warren are recommended.

4.8 A SCS (Schematic of Core Structure) of the *System* whose Performance is to be Improved

This subsection returns to the story line of the first backlog example. Sec 4.3 refers. It draws on what was illustrated in Secs 4.4 to 4.8 to compile a SCS (Schematic of Core Structure). Step 1 of the SD approach, the determination of the PIO (performance improvement objective), was done in Sec 4.3. Step 2, the drawing of POT graphs was done in Sec 4.4. This subsection deals with step 3, the compilation of a SCS of the system whose performance is to be improved.

[The building of an SD model is step 4 in the SD approach. This was done out of sequence in Sec 4.4 to 4.8 above as the purpose was to explain and illustrate the four SD principles with an example. In this subsection we will use the SD principles, terminology and symbols to develop a SCS.]

The purpose of a SCS is to quickly produce, at an early stage, a schematic of the core *structure* of the *system* whose performance is sought to be improved. In this first example *the system* is that which generates and lodges applications in a LR (land registry) where the applications are processed by the LR.

There will likely be several iterations of the SCS during early brainstorming by a project feasibility or design team, composed of both local and non-local specialists. The aim is to quickly produce a schematic that portrays the *system* that can be accepted by all, and for the SCS to be used to reach a joint understanding of the system and its dynamics, and where there may be potential interventions to improve the performance of the system. This will assist “buy in”. Paper and coloured pens can be used to quickly draw a SCS. A completed SCS will assist model building.

4.8.1 A 1st Pass of the SCS where Performance is to be improved

A useful way to proceed is by thinking of system segments such as: - DEMAND; SUPPLY; SUPPLY servicing DEMAND; FEEDBACK. This is essentially following the sequence used in Secs 4.4 to 4.8.

For each segment it is useful to identify: - the main stocks with their inflows and outflows; main variables; how these may be linked, where the feedback loops are.

¹² <https://www.sdcourses.com/>

Fig 4.15a shows the demand side. Fig 4.15c shows the supply side. Fig 4.15d shows supply servicing demand.

The symbols of stocks, flows and variables are used as explained and illustrated in Sec 4.5-4.7.

These figures are hand sketched as they may be in a brainstorming operational setting by a design team of international and local agency specialists.

In *developing economies*, it is common for a % of Titleholders to conduct land transactions bypassing the LR for reasons such as:- to avoid paying government and informal fees; can't see much advantage in having the transaction recorded in the LR; too hard to travel to a LR, etc. It is assumed in this example that ~ 25% of titleholders do not use the LR

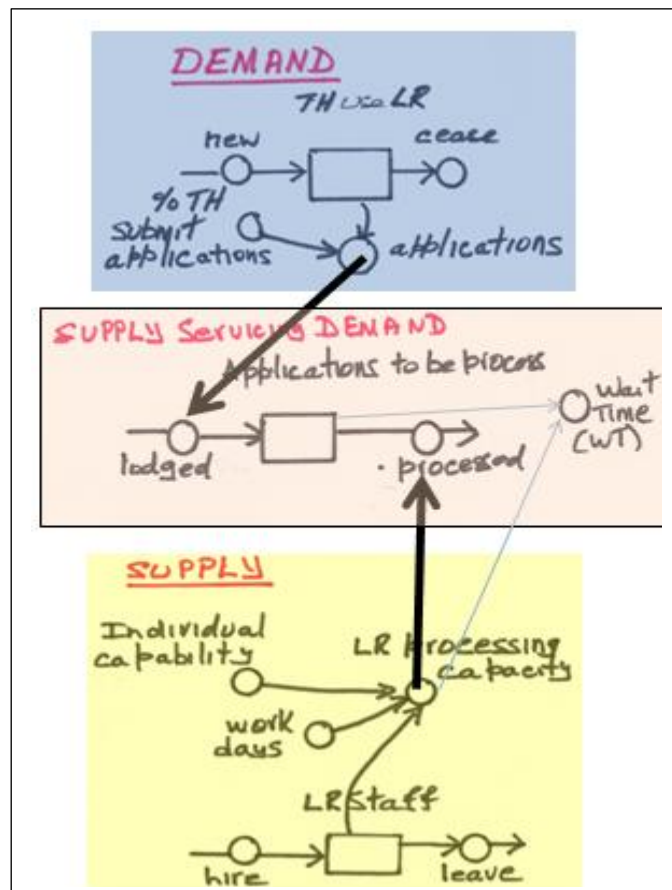


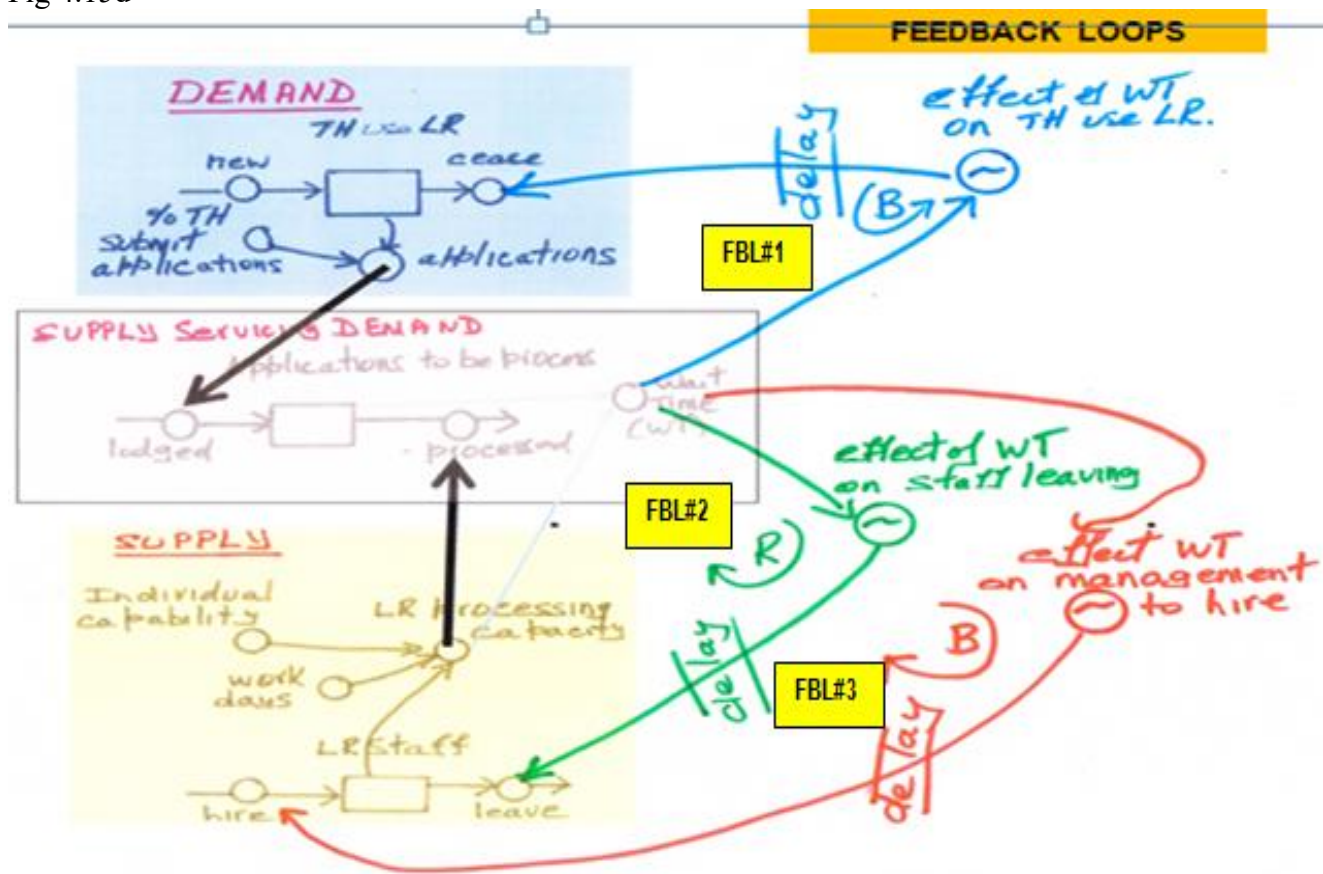
Fig 4.15a

Fig 4.15b

Fig 4.15c

Fig 4.15d includes the feedback loops as explained in Sec 4.7.1.

Fig 4.15d



Observations that can be drawn from the 1st Pass of the SCS

As well as examining the SCS, it is also necessary to include the observations drawn from the POT graphs of backlog (Sec 4.4.2), and observations drawn from the Why, Why, Why diagram (Sec 4.4.1). The following observations can be drawn: -

- That demand (applications for processing) is greater than supply (capacity of the LR to process)
- Processing capacity is low because: - individual productivity is low (low skills; process & workflows unclear and cumbersome); budgets are insufficient for technology)
- The balancing feedback loop, effect of wait time on titleholders leaving, can be strong (long waiting times causes titleholders to no longer use the LR). However, the two other feedback loops are very weak. The reinforcing loop, effect of wait time on staff leaving, is weak as most staff do not wish to leave a secure government job, even if the salary is low. The balancing loop, effect of wait time on management hiring more staff is very weak as Treasury Department will not provide the finance for extra staff.

These observations provide a base to compile a list of potential PIPs (performance improvement proposals). Further observations will be added in Sec 4.9.1.

4.9 Possible “DECISIONS” by LR Management to achieve the PIO (performance improvement objective)

LR Management and its IDA partner will be required to make some management decisions re the actions they consider could achieve the PIO, remove the backlog and keep it low. Some comments were made previously in Sec 4.7.2 re internal decisions.

There are four steps: -

1. Compile a list of *Performance Improvement Proposals* (PIPs)¹³, i.e. possible actions that might remove the backlog and keep it low
2. Incorporate these PIPs into the SCS
3. *Test for effectiveness and sustainability* the various PIPs using the SD model (covered in Chapter 5)
4. Identify the strategy for improvement (also covered in Chapter 5)

Following the above a management decision can then be made on whether or not to proceed to implementation. (Project Evaluation is covered in Chapter 6).

4.9.1 Performance Improvement Proposals (PIPs) – a 1st Pass

A number of possible *Performance Improvement Proposals* (PIPs) were identified in discussions between the in country land agency/LR and the IDA provider on possible ways to remove the large backlog in the LR (with aid) and keep it low (post aid). These discussions were informed by the 1st pass of the SCS.

The 1st pass of PIPs from brainstorming is shown in Annex D. Some were dropped and these together with reasons are shown in Annex D. Table 4.2 lists the PIPs that were agreed should be tested for effectiveness and sustainability. It was decided to include the case of no IDA support provided (PIP#1) which is equivalent to the LR “continue as is” /base case. i.e. the backlog continues to increase. This is a *feared* future POT of Fig 4.3b. PIP#2, same aid as previously, was included as this is also the feared future POT of Fig 4.3c.

Table 4.2

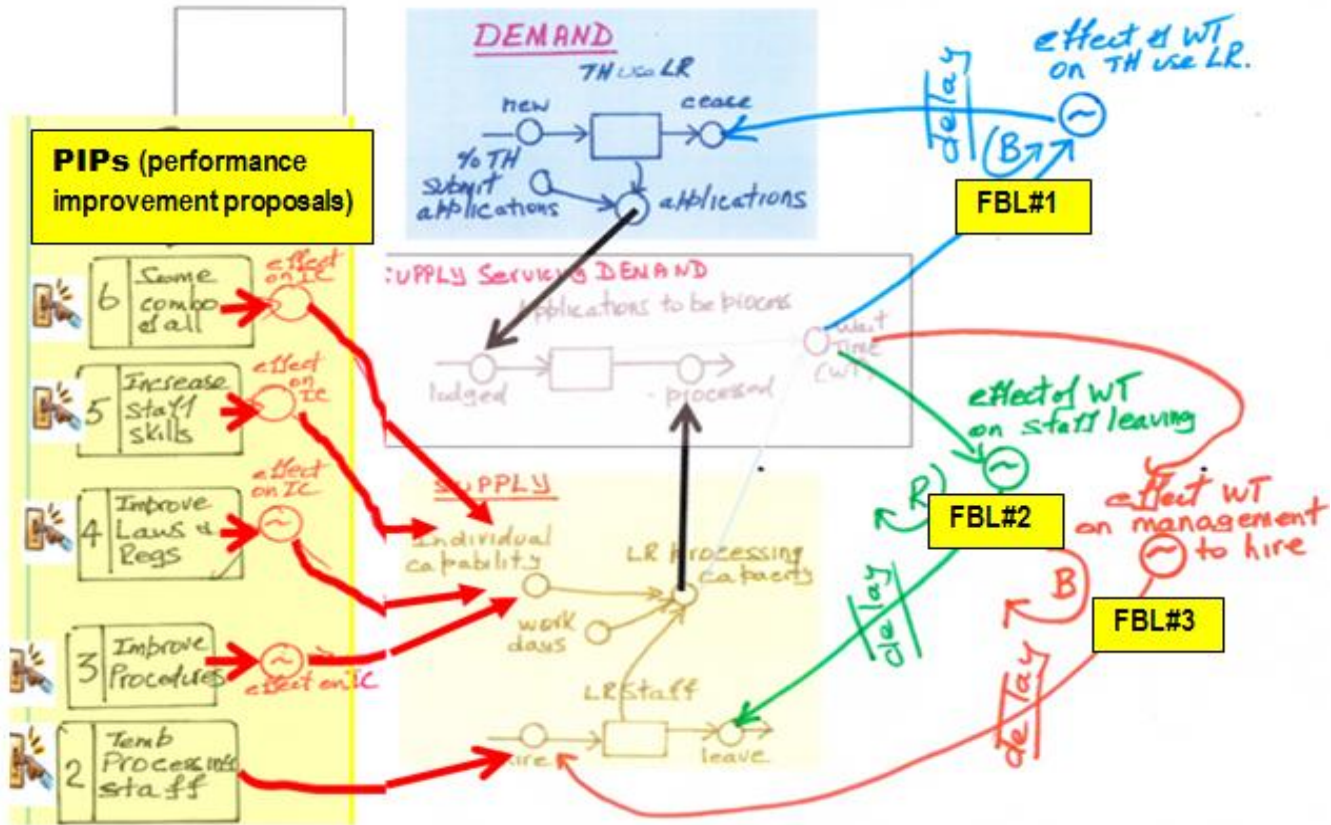
No	Performance Improvement Proposals (PIPs)
1	IDA funding/support not provided
2	Continue to <u>only</u> employ temporary staff, with IDA funding, to clear the backlog when it gets too high
3	Improve the efficiency of LR procedures (within the authority of the CEO) to reduce the time taken to process an application
4	Modify some laws & regulations that are considered out of date &/or too restrictive (Legislative approval necessary) thus leading to reduced time to process an application
5	Increase LR staff skills levels thus leading to reduced time to process an application

¹³ The term *Performance Improvement Proposal* (PIP) is used for any idea that is put forward to improve an existing situation/ system.

6	Some combinations of 2 -5 above. i.e. use temporary local staff <u>once off</u> to significantly reduce the backlog, while at the same time using technical assistance to:-improve the efficiency of procedures and increase LR staff skills and capability;
---	--

Fig 4.15e shows the PIPs included in the 1st pass of the SCS. The red arrows from each PIP show what particular part of the *system* they affect. The light switch besides each PIP indicates that in the SD model PIPs can be turned on/off in any combination to examine their effects.

Fig4.15e



PIPs have a Supply side focus rather than a Demand side focus

The development task being illustrated is that of removing the backlog and keeping it low. The couching of the task in terms of backlog gives it a supply side or internal LR focus. The backlog is clearly visible to LR staff and management as files on desks (or in computer system) waiting to be processed. The size of the backlog is not visible to LR customers and Titleholders who have lodged applications. The concern, from a customer or demand side, is the length of the time they have to wait for their application to be processed.

The PIPs are focused on improving the performance of the supply side, as can be seen from the red arrows in Fig 4.15e emanating from the PIPs to a particular segment on the supply side.

It would be possible to include skills training for major and regular LR customers (banks, developers, notaries etc.). This training could cover LR procedures and forms, common problems with applications, and the like. If applications of a higher quality were lodged, then LR productivity should rise and customer waiting times fall and customer satisfaction rise. This is not included in this example for simplicity.

A SCS (schematic of the core structure) of each PIP

While Fig4.15e provides a SCS of Demand and Supply it does not indicate the SCS of each PIP. These are shown in Annex F.

As noted previously, the purpose of this booklet is not to show how to build a SD model, but rather to explain what the SD approach is, how it can be used, and the results obtained from using. For those interesting in learning how to build SD models Warren's online courses¹⁴ are recommended.

A 1st Pass at PIP inputs

Table 4.3 shows a 1st pass at possible inputs, durations and indicative impact for each PIP. Annex E provides more detail. This was the result of brainstorming by the design team of international and local agency specialists.

Table 4.3

	PIPs	N pers	Duration (mths)	Project start mth	% increase in productivity anticipated	Delay (mths) after TA input before improvement commences	Project mth improvement commences
	Staff						
1	Employ temp staff to remove backlog	5	10	0	NA	0	1
	Increase individual productivity						
2	Improve procedures & workflow (within authority of CEO)	1	6	0	20%	0	6
3	Improve Laws & Regs (needs Legislative approval)	1	6	0	50%	24	30
	Increase staff skills						
4	increase the skill levels of staff	1	6	3	30%	0	start mth 8; full by mth 11
	Combination						
5	Combining 1-4	8	10	0	100%	see above	see above

NB: Even though it has taken most of this Chapter to describe POTs, PIPs and to develop the SCS, in practice a 1st pass at a SCS such as Fig 4.15 and Table 4.4 can be hand drawn quickly in a working meeting between an IDA team and in country LR personnel.

Additional observation from this 1st pass of the SCS (Fig 4.15e) and Table 4.3

Following Fig 4.15d, observations from the first pass of the SCS were drawn. To these can be added (drawn from Fig 4.15ee and Table 4.3):-

- All PIPs aimed at improving the supply side
- PIPs #2,3,4 aimed at improving individual productivity by ~100%, and hence sustainability
- PIP#1 will assist to remove the backlog, but will not contribute to sustainability post aid
- If the Laws & Regs changes (PIP#3) are not passed by the relevant Legislative body, then only ~50% of the target for improved performance will be achieved, and sustainability post aid is unlikely to be achieved.

The above provides much useful information and understanding to the joint international and local design team, but it has some limitations. It is however a possible point at which a start could be made on building an SD model.

Limitations of the 1st Pass of the SCS

The major limitation is that this first pass is essentially qualitative. The only *hard* number is the past POT of the backlog (Fig 4.1). There are still virtually no numbers (even if only indicative) on the stocks, flows and variables of the system depicted in Fig 4.15d. These are essential for quantitative SD model building and the numeric generation of future POTs which in turn allows the *testing* of PIPs for effectiveness and sustainability (detail in Chapter 5).

A 2nd pass at the SCS will provide the additional necessary information.

¹⁴ <https://www.sdcourses.com/>

4.10 A 2nd Pass at the SCS

It is very useful to do a 2nd pass at the SCS in country. It provides further group learning experience and understanding for the joint design team, as it also provides the data necessary for modelling. The data being sought, even if indicative and best estimates, will be obtained from the knowledge of the local specialists.

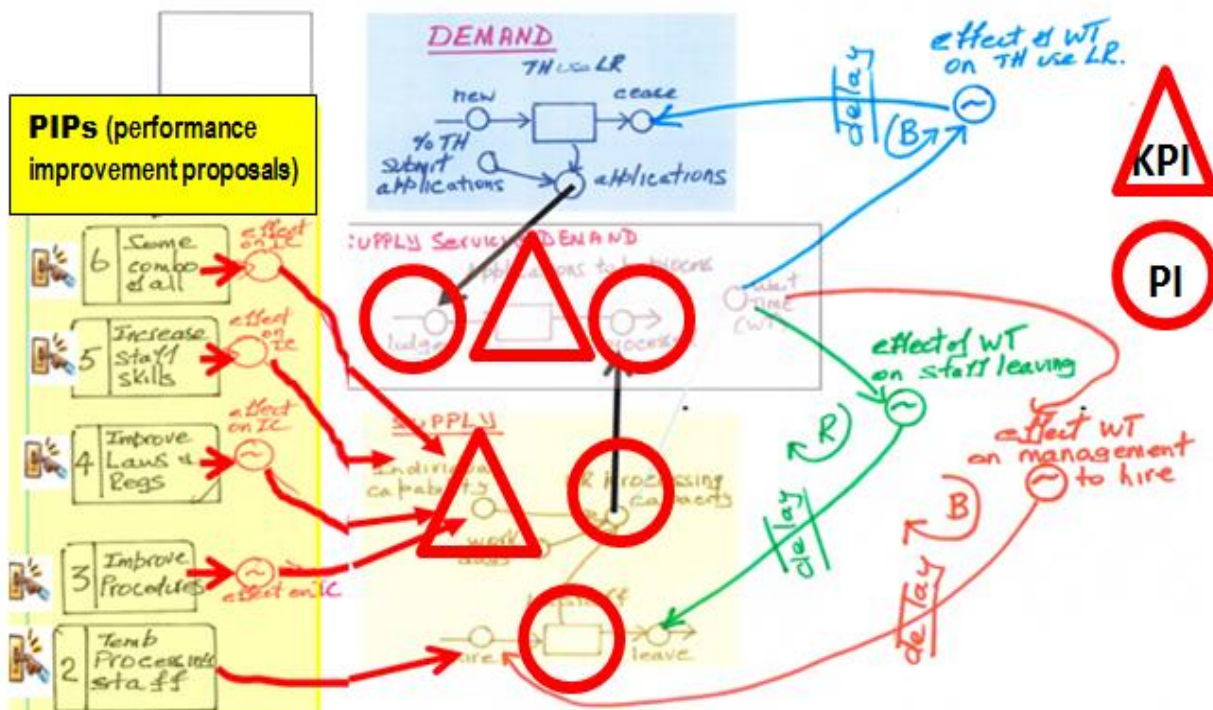
The information sought will be: -

- Identification of the KPIs & PIs (key & performance indicators) of the system depicted in the SCS (Fig 4.15e)
- Data on the main stocks and flows and variables
- The form of graphical function for “effects of on “

4.10.1 KPIs and PIs (key and performance indicators)

This is step 3b in SD approach. Fig 4.15f shows KPI and PI located on the SCS. Comments follow.

Fig 4.15f



KPIs

KPIs are few in number and are entities whose POT values and trajectories need to be watched closely to gauge progress.

One KPI is obviously the PIO (performance improvement objective), backlog. Fig 4.3a showed past and *desired* future POT values and trajectories, and Figs 4.3b, c showed two *feared* future POTs.

The other KPI is individual capability (productivity), Fig 4.15e refers. This is a KPI as four of the PIPs are aimed at improving its value. If individual capability is not increased significantly, then LR processing capacity will not increase significantly, and backlog and waiting time will not sustainably decrease. [Exercise- in Fig 4.15e trace out the path that individual capability effects].

PIs

PIs can be identified from the SCS, Fig 4.15e, as important entities which affect the KPIs or are important in their own right.

A KPI (& PIO) is backlog (a stock) so its inflow, applications lodged, and its outflow, applications processed, will be PIs. A PI is staff (a stock). If staff are absent for any significant time this will lower LR processing capacity and applications processed [LR processing capacity = applications processed = staff (a PI) x workdays x individual capability (a KPI)].

Other

The stock, titleholders who use the LR, is not a PI per se in this example but is important. In the story line of this example, it was noted that ~20% of titleholders are guestimated to not put their land dealings through the LR. [The second illustrative example in Chapter 9 includes a win back campaign to attract back titleholders who do not currently use the LR].

Units

It is important to be clear on the units of the KPIs and PIs. They are shown in Table 4.4.

Table 4.4

KPIs	Units
The backlog /applications to be processed	Number of applications
Individual capability (productivity)	Applications processed/ person/ day
PIs	
Applications lodged	Application lodged in LR/month
Applications processed	Application processed by LR/month
LR staff	Number of staff in LR
LR Processing capacity	Applications /month that LR shold be capable of processing
Other	
Titleholders who use the LR	Number of titleholders who use the LR

4.10.2 POTs of the KPIs and PIs

Fig 4.16 shows best efforts at compiling POT graphs for KPIs and PIs for past and desired future performances for this first illustrative example. As noted in Sec 4.3.3, for LR in developing economies, data on past performance can be hard to determine and is often incomplete. [Fig 4.16 and Figs 4.17a, b are hand sketched as they might be from a working meeting of an in country design team].

Fig 4.16



NB

- Applications generated = applications lodged
- Applications processed = LR processing capacity except where backlog < LR processing capacity
- For completeness POTs have been compiled for other entities in the SCS
- An examination shows for the KPIs, and the PIs of applications processed and LR processing capacity, the difference expected post aid, between this proposed aid and the previous period of aid
- The horizontal axis is months 0 to 150. Time NOW is mth 100

In Chapter 5 the SD model will generate future POTs for the KPIs and PIs for each PIP enabling the effectiveness and sustainability of each PIP to be examined.

KPIs and PIs are further used in Chapter 7 when showing how the SD model can be used for M&E (monitoring and evaluation) during project implementation with aid, and then post aid.

4.10.3 Indicative shapes of “effects of.... on”

Fig14.f of the SCS shows the three feedback loops and the symbols for the graphical functions  that the effect that waiting time for processing has. Fig 4.17a shows a 1st pass at the three graphical functions.

Feedback loops were explained in Section 4.7.1, and the mechanics of “effect of ...on.....”, and the shape of graphical functions were explained in the text associated with Fig 4.13a,b,c.

Fig 4.17a

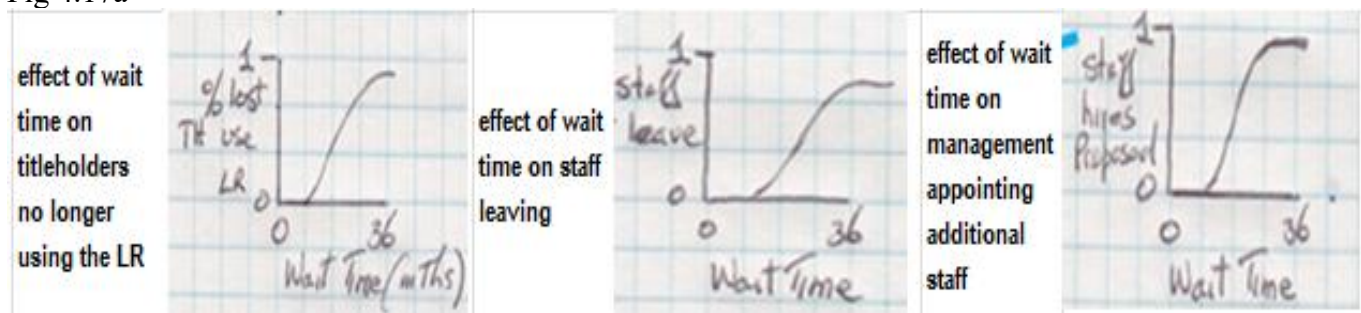
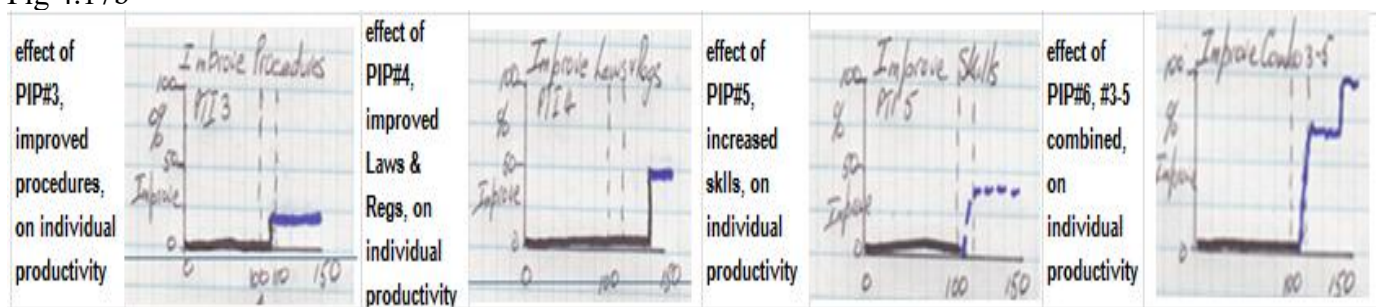


Fig 4.15f showed that each of PIPs#3-6 have an “effect on individual capacity (productivity)”. Annex F showed a SCS for each of these PIPs. Fig 4.17b shows a 1st pass at the graphical functions that indicate the anticipated effect of each PIP on individual capacity (productivity).

Fig 4.17b



4.10.4 Observations that can be drawn from the 2nd pass at the SCS (Fig 4.15f) and Fig 4.16 and Fig 4.17a, b

Observations from the 1st pass at the SCS were listed following Table 4.4. It can be helpful on site to greatly enlarge the SCS and superimpose the various graphs of Figs4.16 and 2.17a, b as an aid for discussion and understanding

The following additional observations can be drawn from the 2nd pass at the SCS.

- KPIs and PIs of the system have been identified, and indicative POT graphs compiled of past performance and possible future performance with proposed aid. What drives what can be seen from Fig 4.15f
- Time 0 mth is when data can be estimated from; Time 36 mths is when the first IDA was provided, in the form of five temporary processing staff for 14 months. This IDA removed the backlog, but did not keep it low. Current time is Time 100 mths, when IDA has been again requested to remove the backlog
- There is little doubt that the backlog can be eliminated by using additional temporary staff (PIP#2) as previous aid has achieved this.
- On the supply side, individual processing capability of ~1.4 applications/person/day seems low for comparable situations and approximately 1 effective working day/ person/ week seems to be lost due to cultural and clan business. This results in a low total LR processing capacity which is less than demand, thus causing the backlog.
- Individual processing capability/productivity is THE KPI as: -
 - the aim (with aid) is to basically double productivity and for that to be sustained post aid. [productivity to increase from 1.4 to 2.8 applications processed/person/day . via, improved procedures and workflow by ~20% (PIP#3); via changes to laws & Regs by ~50% (PIP#4); via increasing skills by ~30% (PIP#5)].
 - Individual productivity has a major impact on backlog, the PIO and a KPI. If productivity doubles, then LR processing capacity (supply) should approximately double, thus ensuring that supply should be greater than demand (applications lodged) for some time, thus keeping the backlog very low.
 - If backlog can be kept low, then waiting time will be low, and titleholders should no longer stop using the LR because of long waiting times, i.e. feedback loop #1 will have little impact, (1st graphical function of Fig 4.17a refers)
 - If the doubling of productivity can be achieved with aid, and sustained post aid, then the PIO will most likely be sustained post aid.
- Keeping the backlog low post aid will rely on LR staff and management maintaining the processing improvements post aid that are aimed for during the aid period.
- A serious risk is that if the Laws & Regs changes (PIP#3) are not passed by the Legislative body (hoped for ~2 years after aid finishes), then only ~50% of the target for improved performance will be achieved, and long term sustainability post aid will unlikely be achieved. (The effect of this risk is examined as a *What If* in Chapter 5).
- Building the SCS up in stages while in country will help project design members (often from diverse backgrounds and skill areas), in a group learning experience, to understand the main structure and dynamics in play. This will foster “buy in” from those in country who will be participating in the IDA project and have to live with the results, post aid. Annex G shows the observations that were drawn as the SCS was built up.
- The 2nd pass at the SCS provides sufficient information for a 1st pass at a SD model and its use quantitatively to test the PIPs for effectiveness and sustainability (chapter 5 refers).

For noting

This example of removing a backlog in a LR and keeping it low is not that dissimilar to Warren’s example of an IT Support company in his online extension course. (See footnote 12)

A reasonable question to ask

Q – Why go to all the trouble of drawing up a SCS, when one can just start modelling with software straight away?

A – There are a number of reasons: -

1. Using coloured pens and large sheets of paper helps build collaboration, understanding and buy in; local members of a design team may feel more comfortable with paper rather than looking at a screen where an international “expert” is building a model (probably at a fast rate)
2. International members of a design team will initially probably not have strategy dynamics model building skills
3. Software is tending to be more online as a service. In developing countries there can be issues with electricity continuity, brown outs, internet reliability and band width

4.11 Key Points

- Strategic management is about building and sustaining performance into the future, and this is essentially what IDA seeks to achieve. The aim is to improve the performance over time (POT) of a *system*
- There are four underpinning principles of SD and a number of steps in the SD approach, as illustrated.
- POT (performance over time) graphs are a powerful way to show PIs (Performance Indicators) past performance, the likely (feared) future POT if no changes are made, and the desired future POT and to pose the important questions of WHY, WHERE, and HOW.
- It is possible to quickly produce a SCS (schematic of core structure) of the *system* in which performance is sought to be improved, and to draw useful qualitative operational observations.
- Building the SCS up in stages while in country will help project design members (often from diverse backgrounds and skill areas), in a group learning experience to understand the main structure of the system and the dynamics in play. This will foster “buy in” from those in country who will be participating in the IDA project and who have to live with the results, post aid.
- The final form of the SCS and observations drawn, while quite useful, are essentially qualitative. However, they provide necessary material for building a quantitative SD model and for testing PIPs for effectiveness and sustainability.

The next chapter will outline the SD model that was built based on the SCS and test the PIPs listed in Table 4.4 for effectiveness and sustainability.

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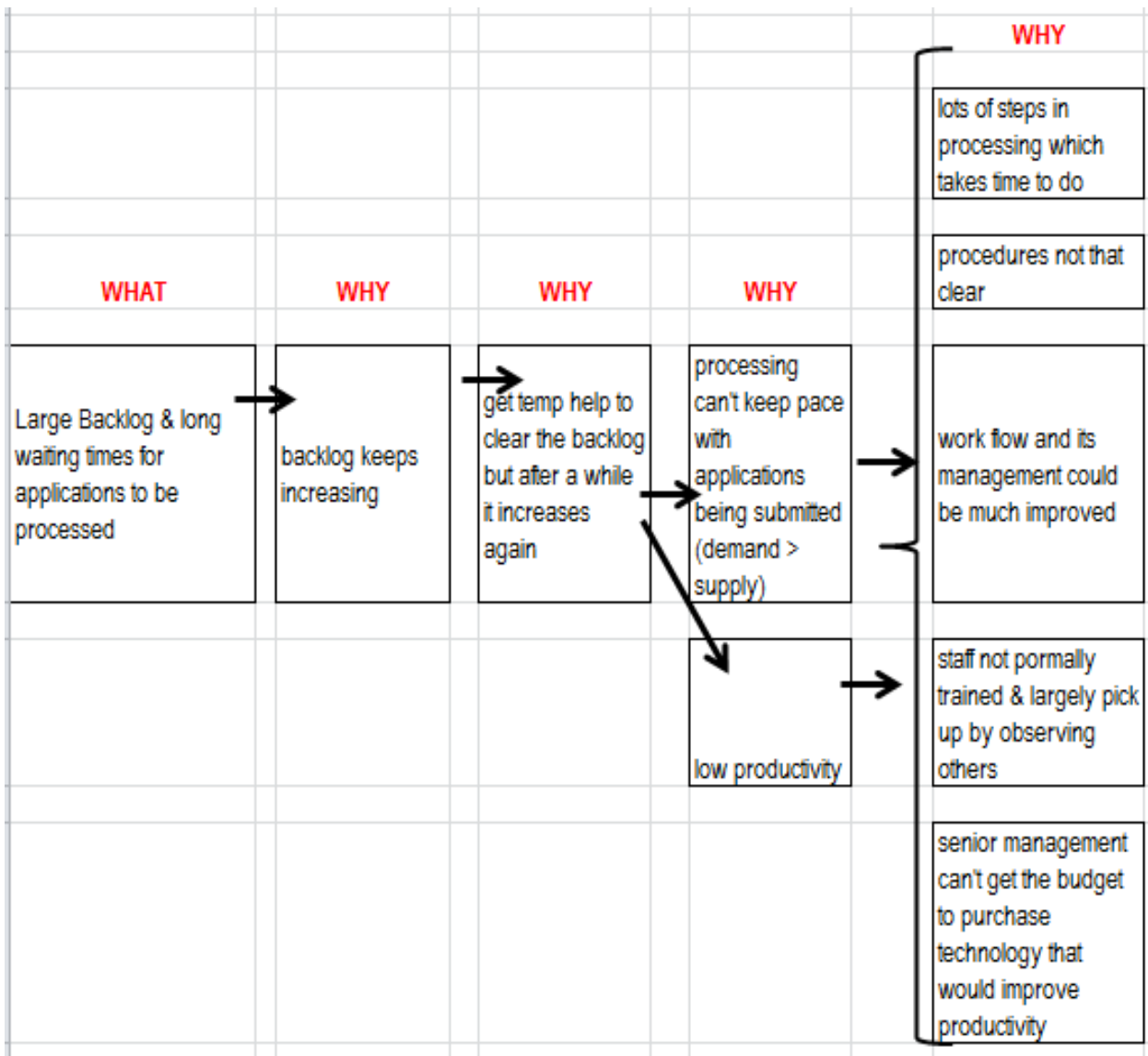
For information

Warren (2017a), <https://www.youtube.com/watch?v=IHF6S8sRItw>;

Warren (2017b), https://www.youtube.com/watch?v=NRx_05p_r8Y

ANNEX A

WHY, WHY, WHY, DIAGRAM



ANNEX B

Some names and units for resources (stocks) in LA, and names and units for associated inflows and outflows.

Stock/ Resource	Units of Resource	Inflows	outflows	Units of Inflows & outflows
Titles	Number (N) of Titles	Land titles by initial right registration (IRR); Titles created by subdivision of already registered land;	Titles extinguished	N Titles per month
Landholders with no title/ rights recorded	N landholders	“new” land/ property holder	Landholders whose rights have been recorded	N landholders per month
Landholders with title/ rights recorded	N Title/ rights holders	Landholders whose rights have been recorded	Titles extinguished	N landholders per month
Landholders with title/ rights recorded who use the LR to record subsequent land dealings	N Title/ rights holders	Title/ rights holders who use the LR	Title/ rights holders who stop using the LR	N landholders per month
Landholders with title/ rights recorded who do not use the LR to record subsequent land dealings	N Title/ rights holders	Title/ rights holders who do not use the LR	Title/ rights holders who switch to using the LR	N landholders per month
Staff (in Land Agency or LR)	N people	Hire of new permanent staff; hire of temporary staff	Resign; Dismissed, end of contract	N People per month
Customers/user of LR services	N People or businesses	Person wanting to register a land transaction with the LR;	Persons whose land transaction has been registered with the LR	N Persons per month
Work to be done; applications to be processed; backlog	N Land applications awaiting processing	Land applications submitted;	land applications processed and completed	N land applications per month
Land services	N services	New Services added	Existing services discontinued	N Services per year
Staff morale	Rating 0-1 or 1-10	Actions that raise morale or work to maintain;	Actions that cause a fall in morale	N Actions per month & their effect on morale
Public confidence in the LR/ Land Agency	Rating 0-1 or 1-10	Actions that raise public confidence or work to maintain;	Actions that cause a fall in public confidence	N Actions per month & their effect on public confidence
Propensity to charge informal fees	Rating 0-1 or 1-10	Actions that raise or maintain this propensity	Actions that cause a fall in propensity	N Actions per month & their effect propensity

ANNEX C

SOME INFORMATION on PIs (Performance Indicator)

Performance indicator	What the Performance is	Units	Demand Side	Supply side	Using Historical data	Estimated	Stock	Inflow	Outflow	Variable
Backlog (applications to be processed)	Number of applications waiting to be processed	N application		X	X		X			
Applications lodged	Number of application lodged	N application / mth	X		X			X		
LR staff	Number of staff working in the LR	N Staff		X			X			
Waiting time	Time that a customer waits for an application to be lodged	Months	X			X				X
Individual processing capability	Productivity of an individual to process applications	Applications/ person / day		X		X				X
LR processing capacity	Productivity of the LR as a whole to process applications	Application /month		X		X				X

ANNEX D

PTIS FROM BRAINSTORMING

Original list of PTIs from brainstorming session

No	<i>"Proposals to Improve" (PTI)</i>
1	Request treasury department to fund more permanent staff and to purchase technology
2	Continue to <u>only</u> employ temporary staff, with IDA funding, to clear the backlog when it gets too high
3	Improve ¹⁵ the efficiency of LR procedures to reduce the time taken to process an application
4	Modify some laws & regulations that are considered out of date and/or too restrictive. This PTI leads to reduced time to process an application
5	Increase LR staff skills levels thus leading to reduced time to process an application
6	Some combinations of 2 -5 above
7	Gain an increase in the number of effective days worked per month closer to the nominal days to be worked. (time is taken off for cultural and clan business)
8	Reduce the propensity to charge informal fees (IFF)/ facilitation fees / speed fees (to get a particular application processed quickly & hence jump the backlog queue)
9	Seek to attract back to the LR, the guestimated~30% of Titleholders who do not conduct land dealings through the LR
10	Upgrade & improve the operations of the LR so that it is closer to meeting the developed economy characteristics of an effective LR, and becomes a revenue source for Government, rather than a cost.

PTIs ruled out with the reasons.

1	Treasury department had made it quite clear that no extra funding would be provided until the LR could show sustained productivity improvement, and an increase in fees collected. Also, IDA funds cannot be used to fund permanent staff. It is hoped that with IDA assistance to implement some improvements, then a sustained improvement in productivity could be demonstrated, and Treasury may then be willing to consider a case to appoint more permanent LR staff and the use of technology.
8, 9, 10	Were felt to be more appropriate for a bigger project to improve the overall operation of the LR
7	While not fully ruled out (on cultural grounds), it was thought that this could be examined as a <i>What If</i>

¹⁵ improvements here will be limited to those that can be carried out using the authority of the Director General of Lands and Registrar of Titles or equivalents and thus approved and implemented fairly quickly

ANNEX E

FIRST PASS –IDA INPUTS, DURATIONS, QUANTUM OF IMPROVEMENT HOPED FOR

PTI #1- No IDA funding/support provided

Remarks

This is not really a PTI; it is included to show the likely future POT of the backlog if no IDA support is provided. i.e. it quantifies the likely size of the backlog at any future time.

Input - Nil

PTI #2 - Continue to only employ temporary staff, with IDA funding, to clear the backlog when it gets too high

Remarks

This IDA was previously provided in the past from months ~37-50. It comprised five temporary local staff for ~12 mths or until the backlog was almost removed. PTI#2 is simply repeating this every time when the backlog reaches ~1000 applications.

The input

Start Mth or condition	Duration (mths)	N. Temp staff (IDA funded)				
Initially Mth 100; whenever backlog ~1000	12	4				

In system dynamics this is referred to as “the fix that fails”. Einstein noted – “we cannot solve problems by using the same kind of thinking we used to create them”.

PTI #3 - Improve¹⁶ the efficiency of LR procedures

Remarks

The current procedures that the LR are using were considered reasonably inefficient, not clear, or easy to follow, and in some areas, there were no written procedures, and various staff had different interpretations. It was decided to distinguish between parts of the procedures involving changes that could be approved completely within the Department, by a CEO/DG or similar, and thus implement quickly while the TA (procedures) (Technical Advisor) was on site. The TA could be either local or international. Improving procedures that involved changes to Laws or Regulations were to be addressed via PTI#4. A graphical function was used in the SD model to quantify the effect of new procedures on capability.

The input

Start Mth or condition	Duration (mths)	N. TA (IDA funded)	% improvement in individual capability anticipated			
100	6	1	20%			

PTI #4 - Modify some Laws & Regulations that are considered out of date & too restrictive, to further improve procedures

Remarks

It is not uncommon in developing economies for many Laws to be very prescriptive and for some of these aspects to be handled, in developed economies, administratively by regulation. In general Laws can only be changed by Parliament or equivalent, whereas the Government of the day can change regulations. Good governance requires safeguards, balance and prudence to minimize the potential for corruption.

It was decided that a TA (Laws and Regs) can examine existing laws and Regulations, consult with stakeholders, draft improvements. etc., but it is up to the Department, its Minister, the Government, and

¹⁶ improvements here will be limited to those that can be carried out using the authority of the Director General /Registrar of Titles or equivalent

Parliament to bring recommended changes into law. It can take some time (in some cases years) for drafted changes to be passed into law and hence capable of being applied. A graphical function was used in the SD model to determine the effect of changes in Laws & Regs on capability.

Input

Start Mth or condition	Duration (mths)	N. TA (IDA funded)	% improvement in LR staff capability anticipated	Delay (mths) allowed after TA input, before draft Law/Regs approved		
100	6	1	50%	24		

PTI #5 - Increase LR staff skills levels

Remarks

It is not uncommon for LR staff in developing economies to have low skill levels due to lack of formal structured training, and largely learning on the job by observing others. Individual skill levels may be only half of what is required for full efficiency. An input to TA to formally increase staff skills to the level required can increase individual staff capability, and hence increase overall LR processing capacity.

The task of the TA was to work with the LR staff to review job positions, duty statements, and skills held and skills necessary, and then to devise and deliver a training program to increase individual skills to the level required and then to provide on the job mentoring to build confidence and proficiency. The model provided for 1 day's formal training per week during the presence of the TA (skills). The remaining time of the TA was to be spent on the tasks listed above, as well as the preparation of training material, and training a senior LR staff person to be able to continue the formal training and on the job mentoring, post the TA (skills). A graphical function was used in the model to determine the effect of new procedures on capability.

Input

Start Mth or condition	Duration (mths)	N. TA (IDA funded)	% improvement in LR staff capability anticipated			
103	6	1	30%			

PTI #6 - Some combination of PTI#2-5

Remarks

This PTI involves combining aspects from PTI#2-5. It is essentially using local temporary staff once off to assist to reduce the backlog, while at the same time using the three different TAs, to improve procedures, laws & regs, and skill levels, so that LR staff have a sufficiently increased capability to keep the backlog at a reasonable level, and do not require any future IDA in this area.

Input

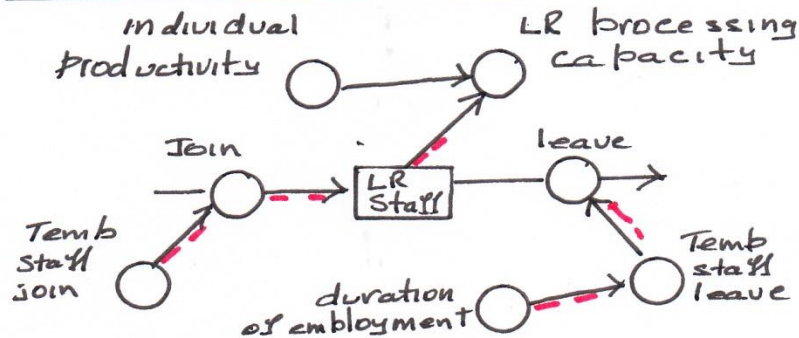
From	PTI Description	Start Mth or condition	Duration (mths)	N. Temp staff	% improvement in LR staff capability anticipated	Delay (mths) allowed after TA input, before draft Law/Regs approved
From PTI#2	Use Temp processing staff when backlog ~1000	Start Mth 100; whenever backlog ~1000	12	5	0%	0
From PTI#3	Improve procedures	100	6	1	20%	0
From PTI#4	Improve Laws & Regs	100	6	1	50%	24
From PTI#5	Increase LR staff skills level	103	6	1	30%	0

ANNEX F

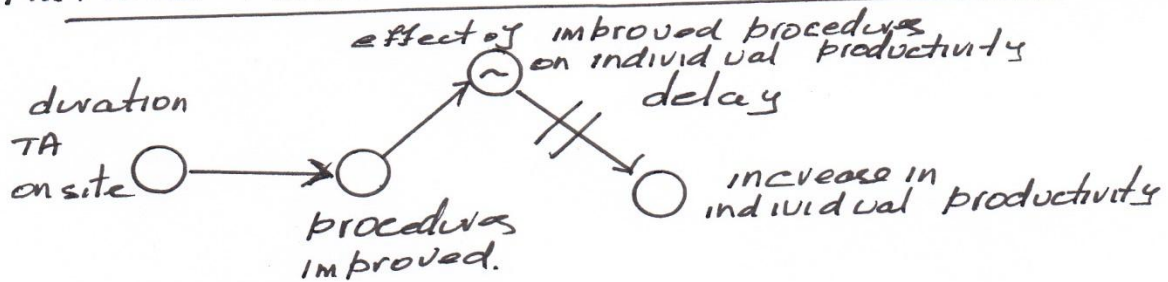
SCS (schematic of core structure) of each PIP

SCSs are hand sketched as they might be from a working meeting of an in country design team

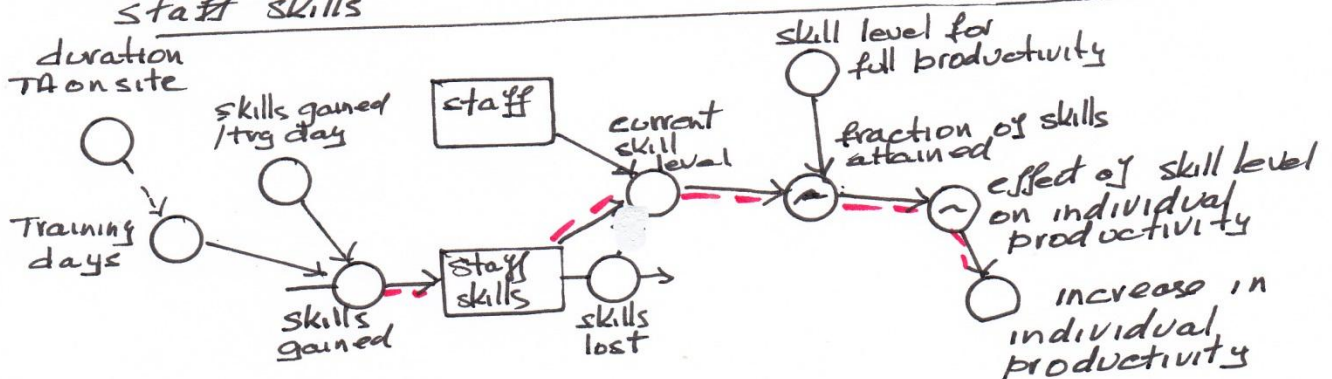
PIP #1: Use Temporary staff to supplement LR processing staff to remove backlog



PIP #2,3: Use TA (Technical Advisors) to assist to improve procedures & Laws + Regs & to train staff



PIP #4: Use TA to train & mentor staff & increase staff skills



ANNEX G

A CONSOLIDATED LIST OF OBSERVATIONS FROM THE SCS AND ASSOCIATED DATA

What the WHY, WHY, WHY, diagram (Annex A) indicates: -

- That demand (applications for processing) is greater than supply (capacity of the LR to process)
- Processing capacity is low because: - productivity is low (low skills; process & workflows unclear and cumbersome); budgets are insufficient for technology)

Observations that can be drawn from the 1st Pass of the SCS Fig 4.15d)

As well as examining the SCS, it is also necessary to include the observations drawn from the POT graphs of backlog (Sec 4.4.2), and observations drawn from the Why, Why, Why, diagram (Sec 4.4.1 and Annex A). The following observations can be drawn: -

- That demand (applications for processing) is greater than supply (capacity of the LR to process)
- Processing capacity is low because: - individual productivity is low (low skills; process & workflows unclear and cumbersome); budgets are insufficient for technology)
- The balancing feedback loop, the effect of wait time on titleholders leaving, can be strong (long waiting times causes titleholders to no longer use the LR). However, the two other feedback loops are very weak. The reinforcing loop, effect of wait time on staff leaving, is weak as most staff do not wish to leave a secure government job, even if the salary is low. The balancing loop, effect of wait time on management hiring more staff is very weak as Treasury Department will not provide the finance for extra staff.

These observations provide a base to compile a list of potential PIPs (performance improvement proposals). Further observations will be added in Sec 4.9.1.

Additional observation from this 1st pass of the SCS (Fig 4.15e) and Table 4.4

Following Fig 4.15d observations from the 1st pass of the SCS were drawn. To these can be added (drawn from Fig 4.15e and Table 4.4): -

- All PIPs are aimed at improving the supply side
- PIPs #2,3,4 are aimed at improving individual productivity by ~100%, and hence sustainability
- PIP#1 will assist to remove the backlog but will not contribute to sustainability post aid
- If the Laws & Regs changes (PIP#3) are not passed by Legislative body then only ~50% of the target for improved performance will be achieved, and sustainability post aid unlikely to be achieved.

4.10.4 Observations that can be drawn from the 2nd pass at the SCS (Fig 4.15f) and Fig 4.16 and Fig 4.17a, b

. Observations from the 1st pass at the SCS were listed following Table 4.4. It can be helpful, on site, to greatly enlarge the SCS and superimpose the various graphs of Figs 4.16 and 4.17a,b as an aid for discussion and understanding

The following additional observations can be drawn from the 2nd pass at the SCS.

- KPIs and PIs of the system have been identified, and indicative POT graphs compiled of past performance and possible future performance with proposed aid. What drives what can be seen from Fig 4.15f
- Time 0 mth is when data can be estimated from; Time 36 mths is when the first IDA was provided, in the form of five temporary processing staff for 14 months. This IDA removed the backlog, but did not keep it low. Current time is Time 100 mths, when IDA has been again requested to remove the backlog
- There is little doubt that the backlog can be eliminated by using additional temporary staff (PIP#2) as previous aid has achieved this.
- On the supply side, individual processing capability of ~1.4 applications/person/day seems low for comparable situations and approximately 1 effective working day/ person/ week seems to be lost due to cultural and clan business. This results in a low total LR processing capacity which is less than demand, thus causing the backlog.
- Individual processing capability/productivity is THE KPI as: -

- the aim (with aid) is to basically double productivity and for that to be sustained post aid. [productivity to increase from 1.4 to 2.8 applications processed/person/day . via, improved procedures and workflow by ~20% (PIIP#3); via changes to laws & Regs by ~50% (PIP#4); via increasing skills by ~30% (PIP#5)].
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 - If backlog can be kept low, then waiting time will be low, and titleholders should no longer stop using the LR because of long waiting times, i.e. feedback loop #1 will have little impact, (1st graphical function of Fig 4.17a refers)
 - If the doubling of productivity can be achieved with aid, and sustained post aid, then the PIO will most likely be sustained post aid.
- Keeping the backlog low will rely on LR staff and management maintaining the processing improvements post aid that are aimed for during the aid period.
 - A serious risk is that if the Laws & Regs changes (PIP#3) are not passed by the Legislative body (hoped for ~2 years after aid finishes), then only ~50% of the target for improved performance will be achieved, and long term sustainability post aid will be unlikely to be achieved. (The effect of this risk is examined as a *What If* in Chapter 5).
 - Building the SCS up in stages while in country will help project design members (often from diverse backgrounds and skill areas), in a group learning experience to understand the main structure and dynamics in play, and thus foster “buy in” from those in country who will be participating in the IDA project and have to live with the results, post aid.
 - The 2nd pass at the SCS provides sufficient information for a 1st pass at a SD model and its use quantitatively to test the PIPs for effectiveness and sustainability (chapter 5 refers).

ANNEX G

Abbreviations Used

Abbreviations

FBL	Feedback loop
IDA	International development assistance
IRPR	Initial recording of property rights
LA	Land administration
KPI	Key performance indicator
LBM	Living business model
LIS	Land information system
LR	Land Registry
M&E	Monitoring and evaluation
PI	Performance indicator
PIO	Performance improvement objective
PIP	Performance improvement proposals
POT	Performance over time
SD	Strategy Dynamics
SCS	Schematic of the core structure (of the system)
TH	Titleholders